Network Systems Science & Advanced Computing

Biocomplexity Institute & Initiative

University of Virginia

Estimation of COVID-19 Impact in Virginia

July 13th, 2022

(data current to July 10th – July 12th)

Biocomplexity Institute Technical report: TR BI-2022-1618

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About Us

- Biocomplexity Institute at the University of Virginia
  - Using big data and simulations to understand massively interactive systems and solve societal problems
- Over 20 years of crafting and analyzing infectious disease models
  - Pandemic response for Influenza, Ebola, Zika, and others

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Overview

- **Goal**: Understand impact of COVID-19 mitigations in Virginia
- **Approach:**
  - Calibrate explanatory mechanistic model to observed cases
  - Project based on scenarios for next 4 months
  - Consider a range of possible mitigation effects in "what-if" scenarios
- **Outcomes:**
  - Ill, Confirmed, Hospitalized, ICU, Ventilated, Death
  - Geographic spread over time, case counts, healthcare burdens

Key Takeaways

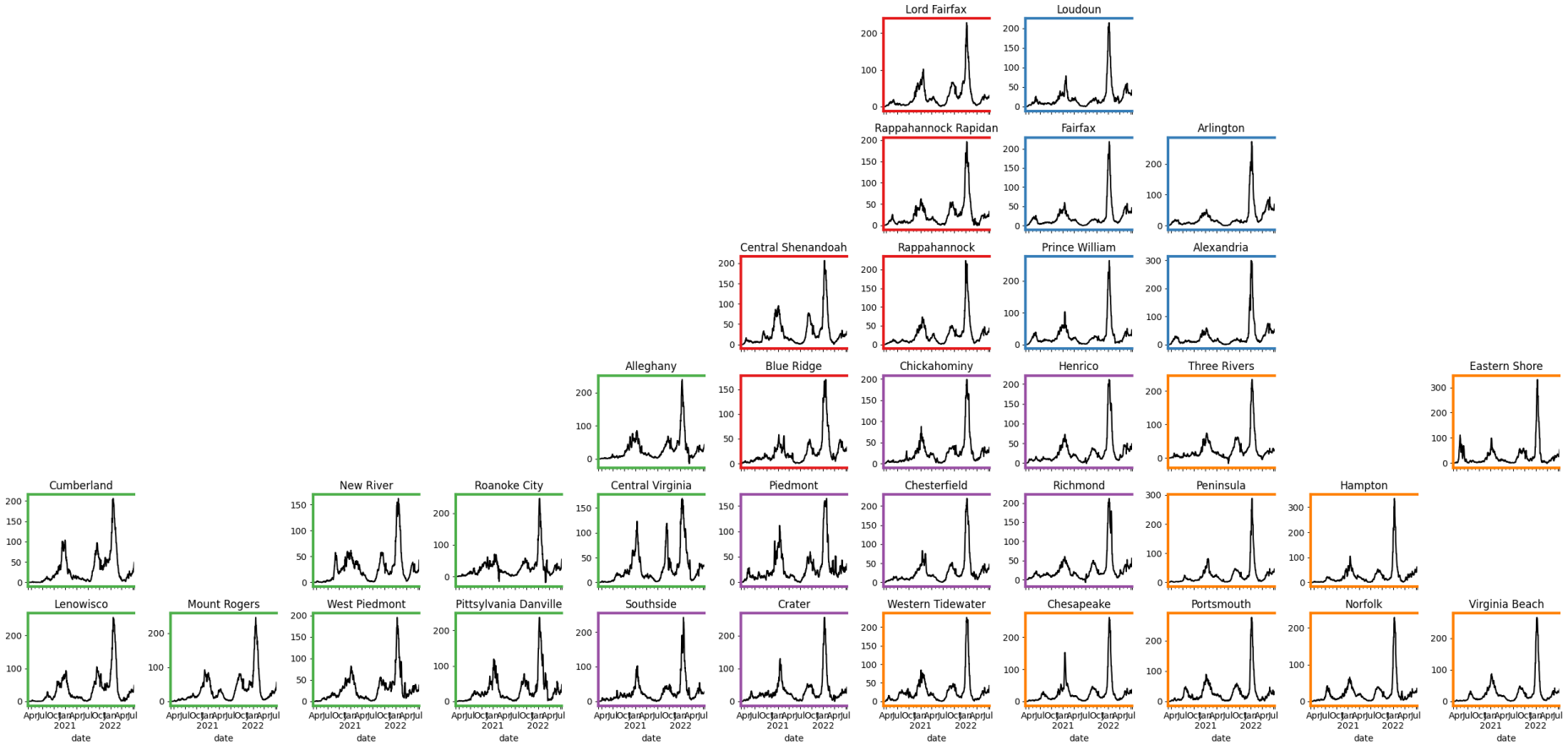
Projecting future cases precisely is impossible and unnecessary.
Even without perfect projections, we can confidently draw conclusions:

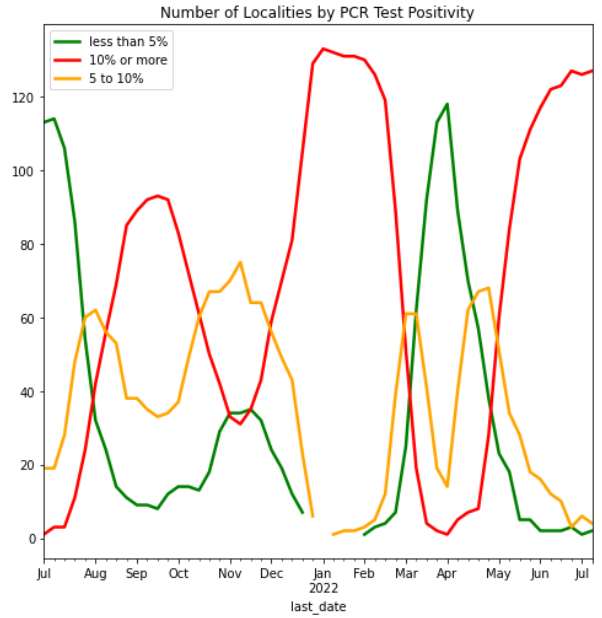
- **Case rates affected by holiday week, but are rising at steady pace as are hospitalizations**
- VA weekly case rate up to 242/100K from 221/100K
  - US also up to 250/100K from 218/100K
  - VA hospital occupancy (rolling 7 day mean of 641) has continued to rise
- Projections anticipate growth in short-term, potential for future growth driven by future sub-variants
- Model updates:
  - BA.5 is now dominate strain and measure growth is now folded into Adaptive scenario
  - Further extended to model to represent additional strains independently during the fitting process, now has separate strains for Omicron BA.1, BA.2, BA.2.12.1, BA.4/5, and future variants (VariantX)
  - Home testing adjustment to case ascertainment applied for fitting and projections

The situation continues to change. Models continue to be updated regularly.

Situation Assessment

Case Rates (per 100k) and Test Positivity





County level RT-PCR test positivity

Green: <5.0% (or <20 tests in past 14 days)

Orange: 5.0%-10.0% (or <500 tests and <2000 tests/100k and >10% positivity over 14 days)

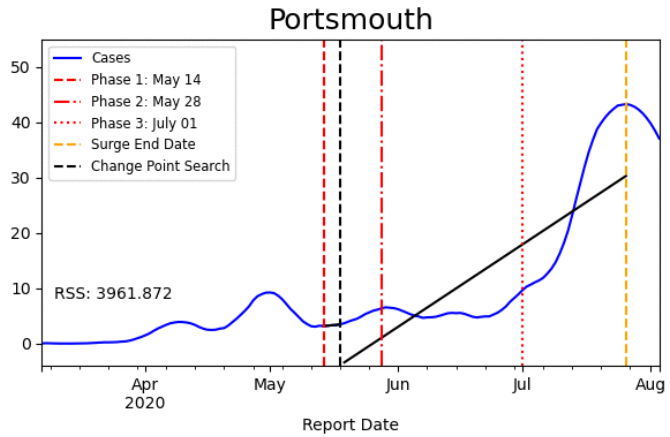
Red: >10.0% (and not "Green" or "Yellow")

District Trajectories

Goal: Define epochs of a Health District's COVID-19 incidence to characterize the current trajectory

Method: Find recent peak and use hockey stick fit to find inflection point afterwards, then use this period's slope to define the trajectory

Hockey stick fit

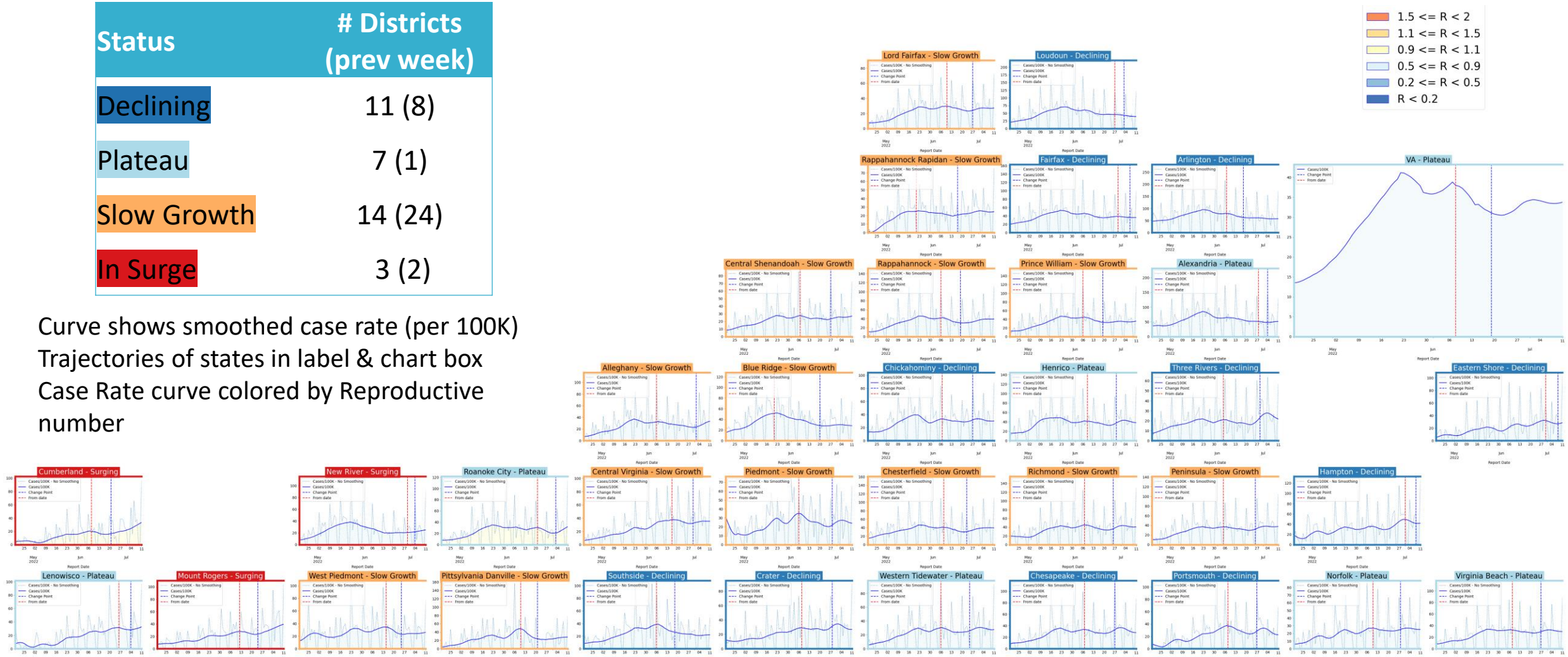


Trajectory	Description	Weekly Case Rate (per 100K) bounds
Declining	Sustained decreases following a recent peak	below -0.9
Plateau	Steady level with minimal trend up or down	above -0.9 and below 0.5
Slow Growth	Sustained growth not rapid enough to be considered a Surge	above 0.5 and below 2.5
In Surge	Currently experiencing sustained rapid and significant growth	2.5 or greater

District Trajectories – last 10 weeks

Status	# Districts (prev week)
Declining	11 (8)
Plateau	7 (1)
Slow Growth	14 (24)
In Surge	3 (2)

Curve shows smoothed case rate (per 100K)
Trajectories of states in label & chart box
Case Rate curve colored by Reproductive number



CDC's new COVID-19 Community Levels

What Prevention Steps Should You Take Based on Your COVID-19 Community Level?

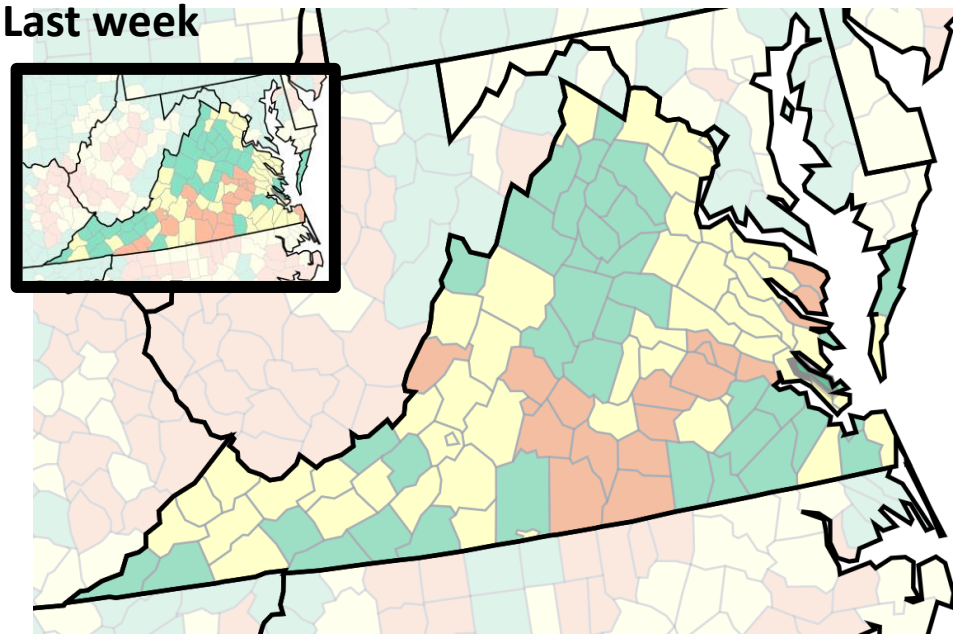
Low	Medium	High
• Stay up to date with COVID-19 vaccines • Get tested if you have symptoms	• If you are at high risk for severe illness, talk to your healthcare provider about whether you need to wear a mask and take other precautions • Stay up to date with COVID-19 vaccines • Get tested if you have symptoms	• Wear a mask indoors in public • Stay up to date with COVID-19 vaccines • Get tested if you have symptoms • Additional precautions may be needed for people at high risk for severe illness

People may choose to mask at any time. People with symptoms, a positive test, or exposure to someone with COVID-19 should wear a mask.

COVID-19 Community Levels – Use the Highest Level that Applies to Your Community

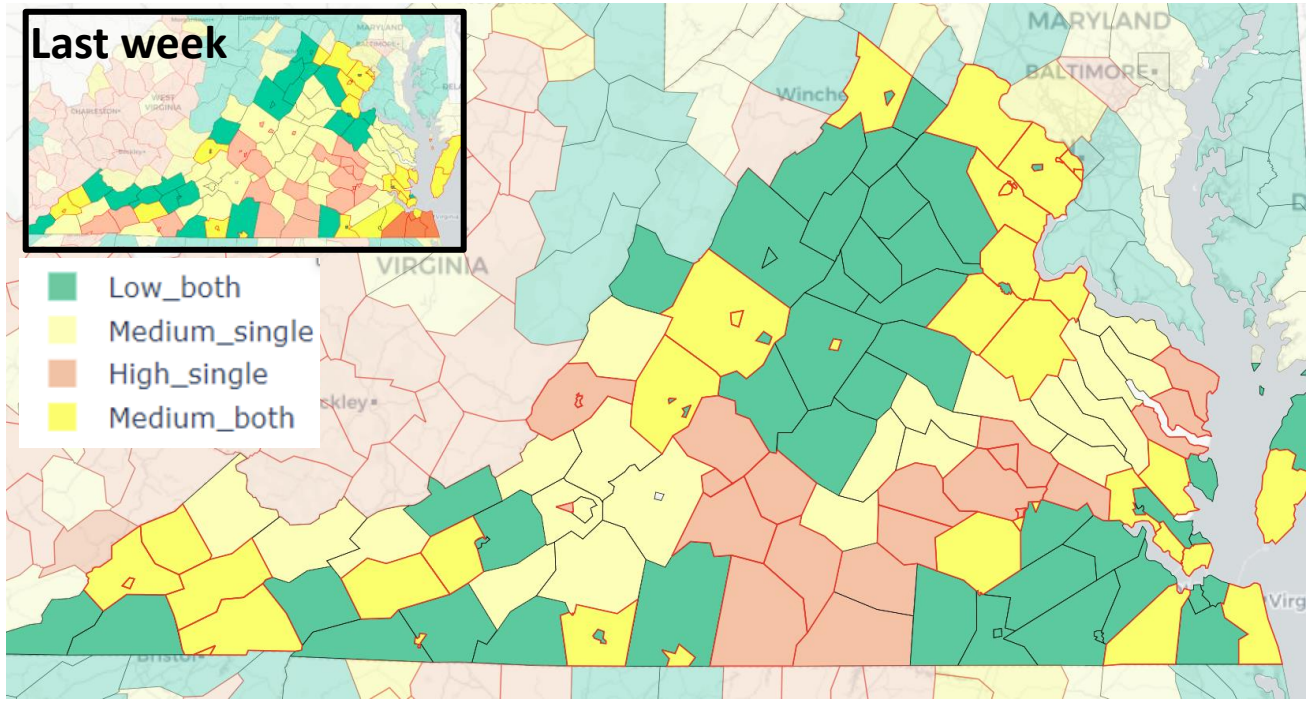
New COVID-19 Cases Per 100,000 people in the past 7 days	Indicators	Low	Medium	High
Fewer than 200	New COVID-19 admissions per 100,000 population (7-day total)	<10.0	10.0-19.9	≥20.0
	Percent of staffed inpatient beds occupied by COVID-19 patients (7-day average)	<10.0%	10.0-14.9%	≥15.0%
200 or more	New COVID-19 admissions per 100,000 population (7-day total)	NA	<10.0	≥10.0
	Percent of staffed inpatient beds occupied by COVID-19 patients (7-day average)	NA	<10.0%	≥10.0%

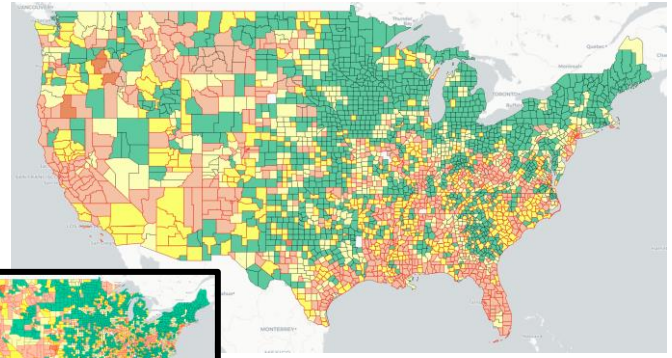
The COVID-19 community level is determined by the higher of the new admissions and inpatient beds metrics, based on the current level of new cases per 100,000 population in the past 7 days



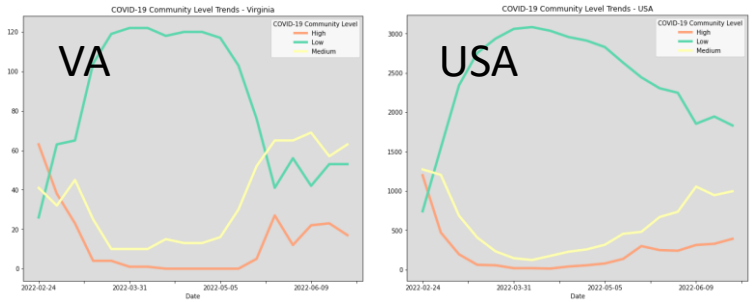
[CDC Data Tracker Portal]

CDC's new COVID-19 Community Levels





Last week



Red outline indicates county had 200 or more cases per 100k in last week

Pale color indicates either beds or occupancy set the level for this county

Dark color indicates both beds and occupancy set the level for this county

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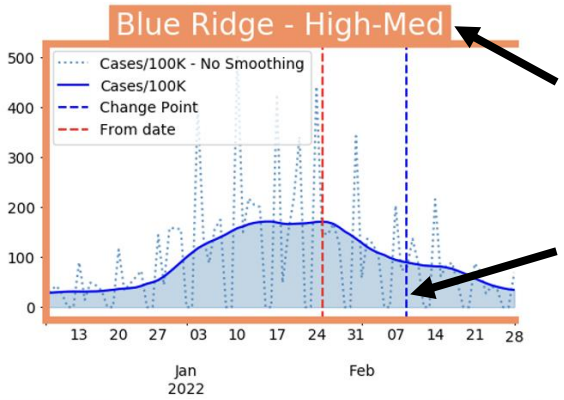
Data from: CDC Data Tracker Portal

District Trajectories with Community Levels

Community Level (Title Color)
- High
- High-Med
- Med-High
- Medium
- Med-Low
- Low-Med
- Low

Curve shows smoothed case rate (per 100K)
CDC's new Community Level aggregated to district level in label & chart box color
Case Rate curve colored by Trajectory

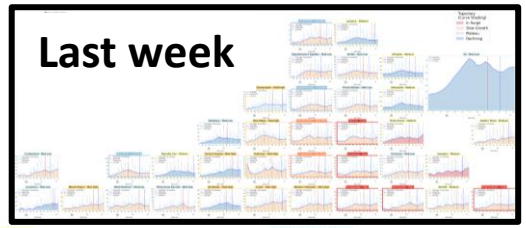
Trajectory (Curve Shading)
- In Surge
- Slow Growth
- Plateau
- Declining



District's Aggregate Community Level

Aggregate level a simple mean of all levels for counties in district

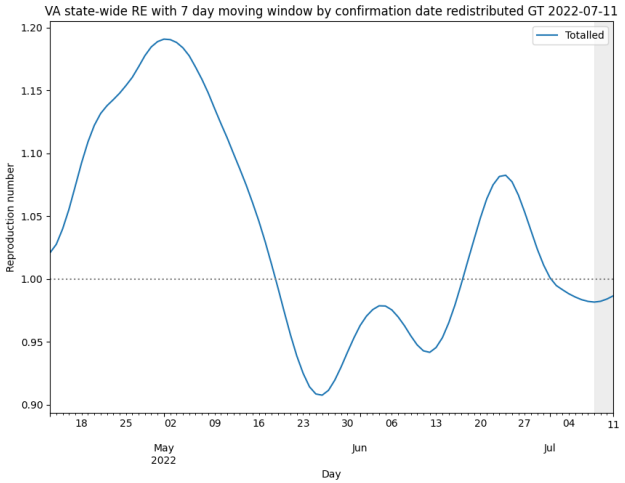
Case rate Trajectory

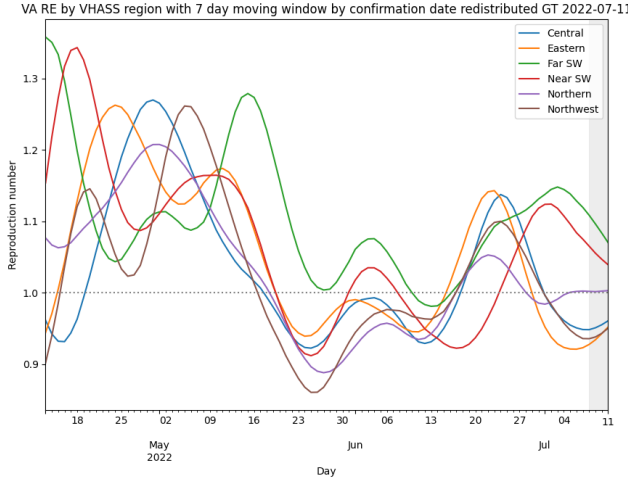


Estimating Daily Reproductive Number – Redistributed gap

July 11th Estimates

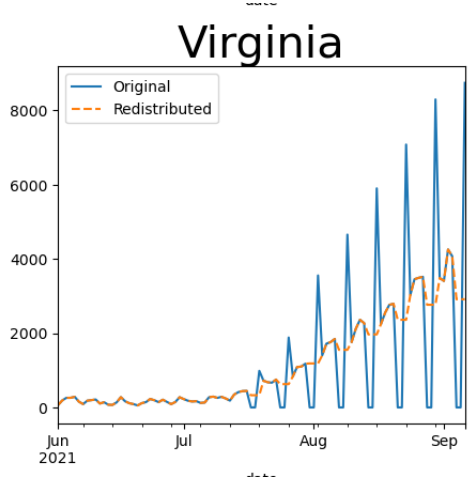
Region	Date Confirmed R_e	Date Confirmed Diff Last Week
State-wide	0.988	0.036
Central	0.964	-0.007
Eastern	0.950	0.004
Far SW	1.068	0.115
Near SW	1.043	0.024
Northern	1.003	0.072
Northwest	0.949	0.016





Skipping Weekend Reports & holidays biases estimates

Redistributed "big" report day to fill in gaps, and then estimate R from "smoothed" time series



Methodology

- Wallinga-Teunis method (EpiEstim[1]) for cases by **confirmation date**
- Serial interval: updated to discrete distribution from observations (mean=4.3, Flaxman et al, Nature 2020)
- Using Confirmation date since due to increasingly unstable estimates from onset date due to backfill

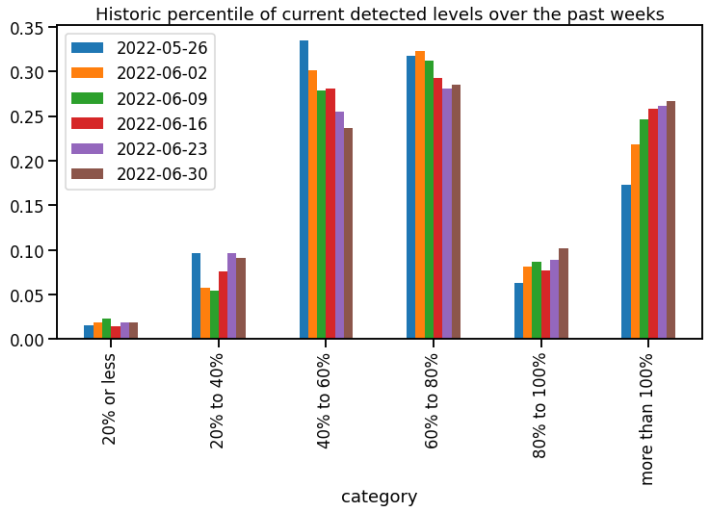
1. Anne Cori, Neil M. Ferguson, Christophe Fraser, Simon Cauchemez. A New Framework and Software to Estimate Time-Varying Reproduction Numbers During Epidemics. American Journal of Epidemiology, Volume 178, Issue 9, 1 November 2013, Pages 1505–1512, https://doi.org/10.1093/aje/kwt133

Wastewater Monitoring

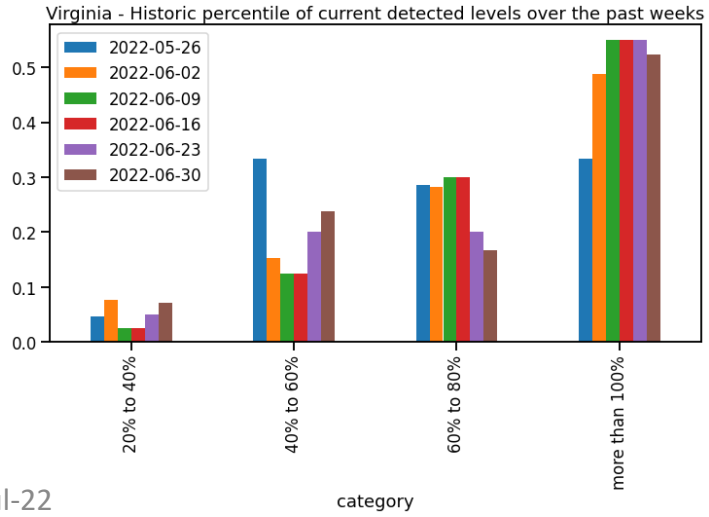
Wastewater provides a coarse early warning of COVID-19 levels in communities

- Overall in the US, there is an increase in sites with increased levels of virus compared to 15 days ago
- Current virus levels are at or exceeding max of previous historical levels, has slowed, though more sites are entering upper quintiles

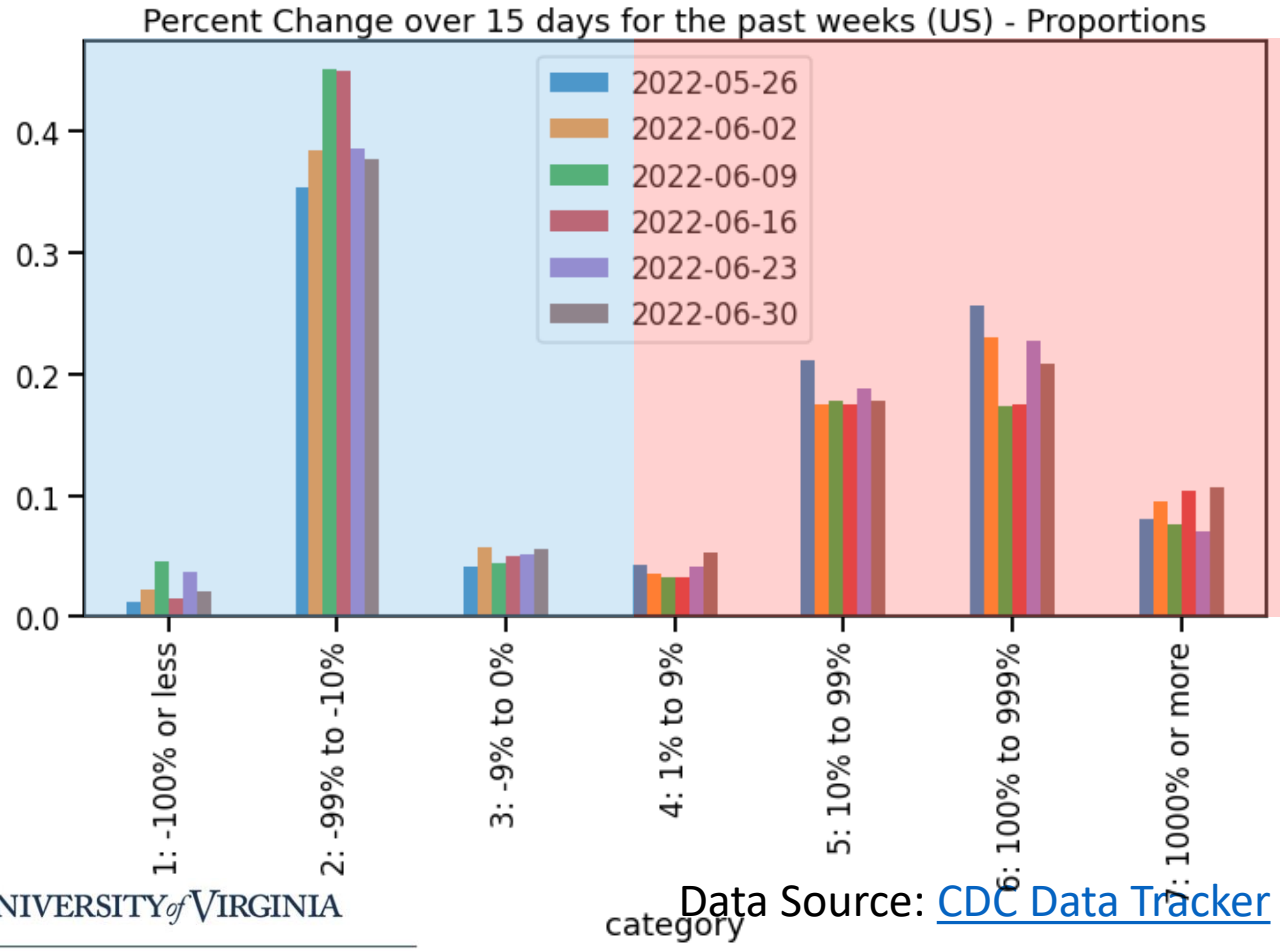
USA



VA



Not fully up to date due to 4th of July, same as last week

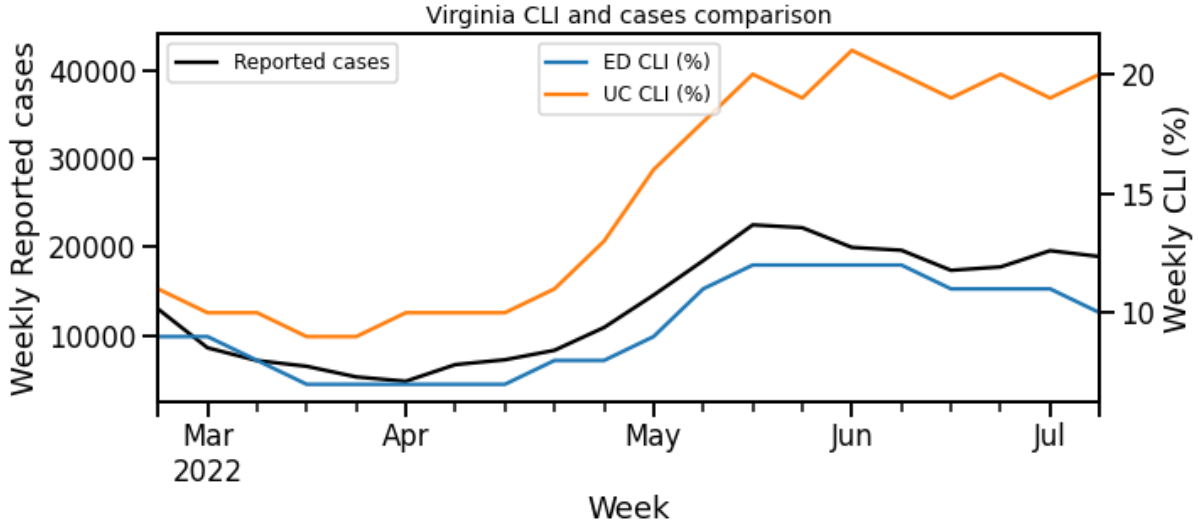


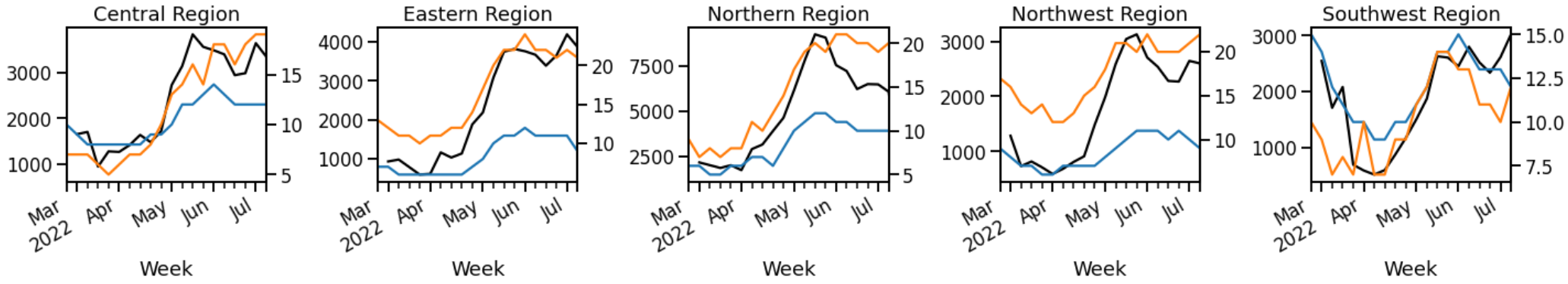
Data Source: CDC Data Tracker

COVID-like Illness Activity

COVID-like Illness (CLI) gives a measure of COVID transmission in the community

- Emergency Dept (ED) based CLI is more correlated with case reporting
- Urgent Care (UC) is a leading indicator but prone to some false positives
- **Current trends in UC CLI have plateaued for last eight weeks state-wide with some regional signs of growth**

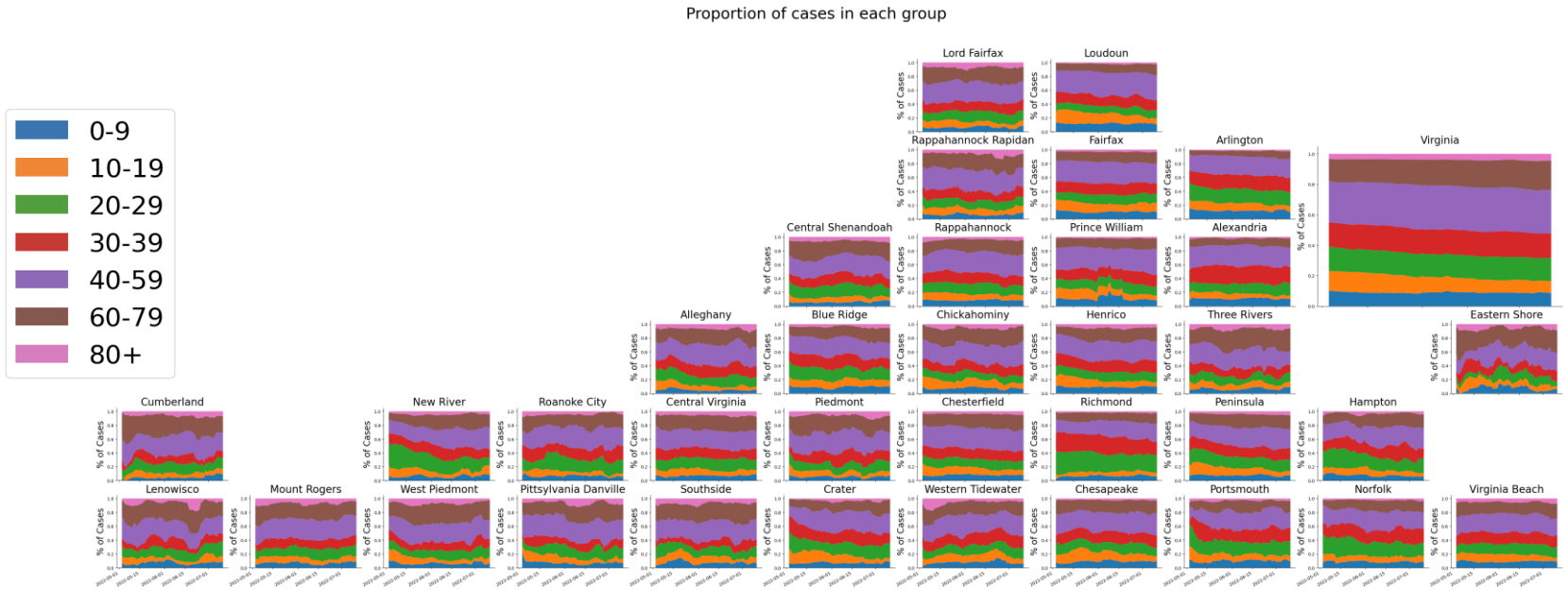


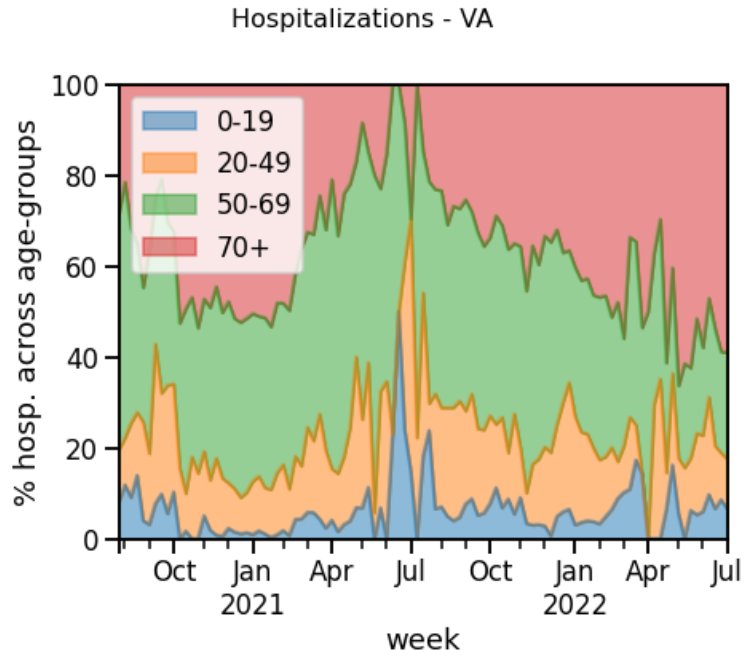


Cases and Hospitalizations – Age Distribution

Older populations make up increasing share of Cases and Hospitalizations

- Cases in last 10 weeks have shifted to 40+ year olds, though the degree varies across districts
- Hospitalizations in VA have increasingly been in 70+ since January 2022





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SARS-CoV2 Variants of Concern

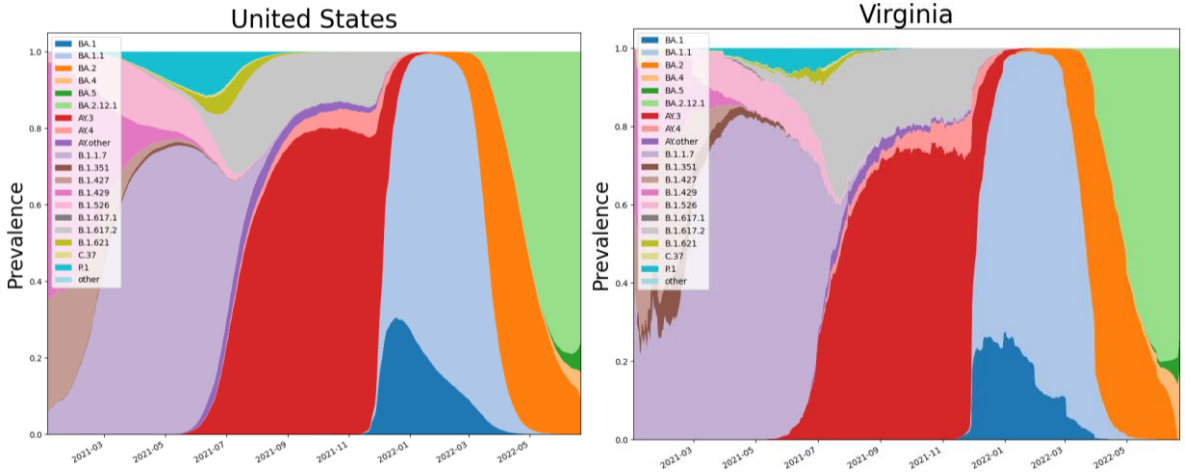
Emerging new variants will alter the future trajectories of pandemic and have implications for future control

- **Emerging variants can:** Increase transmissibility, increase severity (more hospitalizations and/or deaths), and limit immunity provided by prior infection and vaccinations

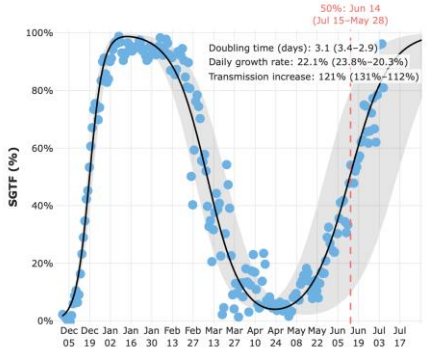
Omicron Updates

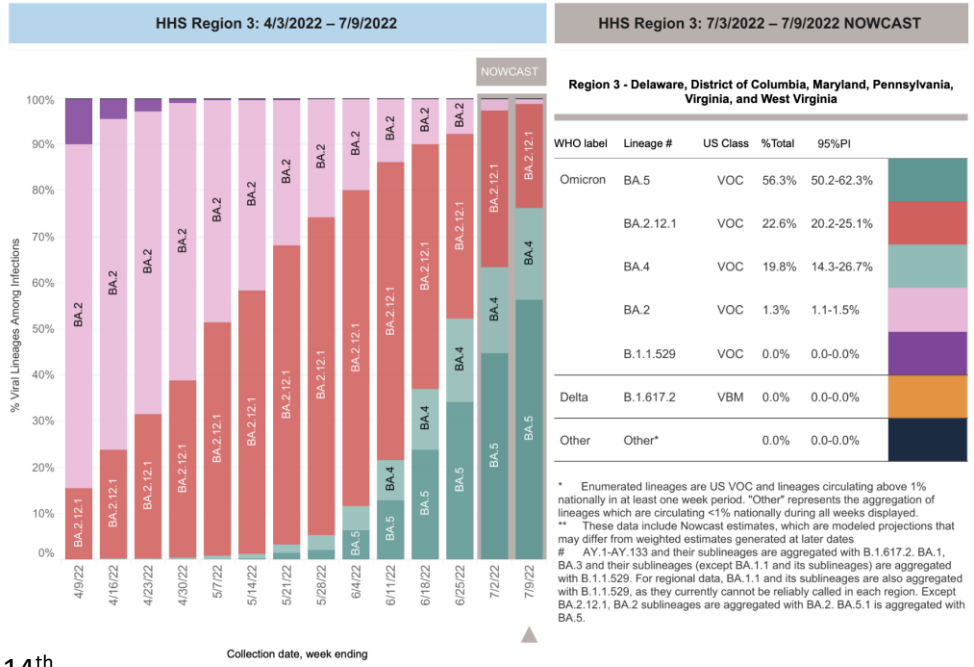
- BA.2.12.1 continues to shrink, now below 25%
- BA.4 has stagnated at 17-19% for past 3 weeks
- BA.5 continues to grow rapidly, nowcasted at 56% (up from 41% last week)
- BA.4 and BA.5 have same mutation as BA.1 that produces S-gene target failure, so can be tracked in more real time with SGTF from some PCR tests

GISAID outbreak.info



SGTF in San Diego



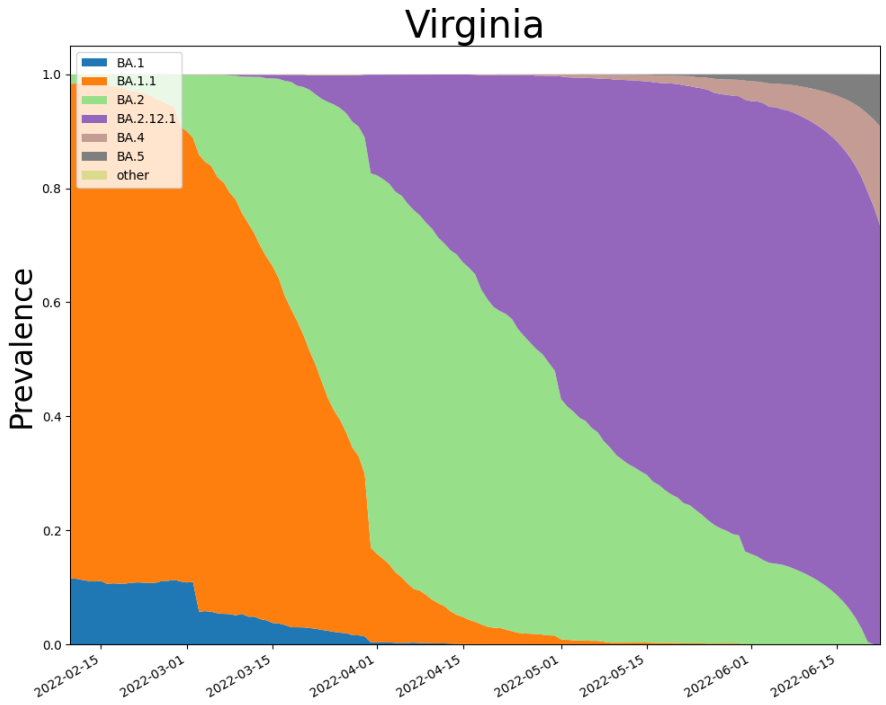


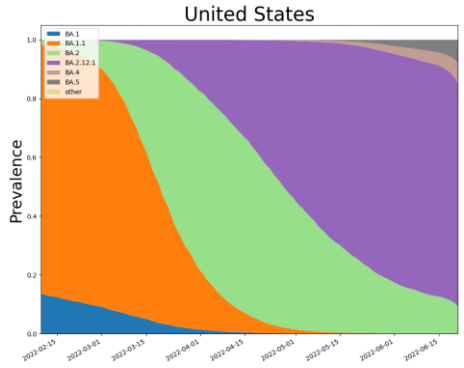
Estimated to be at ~75%, passing 50% on June 14th, Region 9 by CDC data tracker is at ~50% for week ending June 25th

CDC Variant Tracking

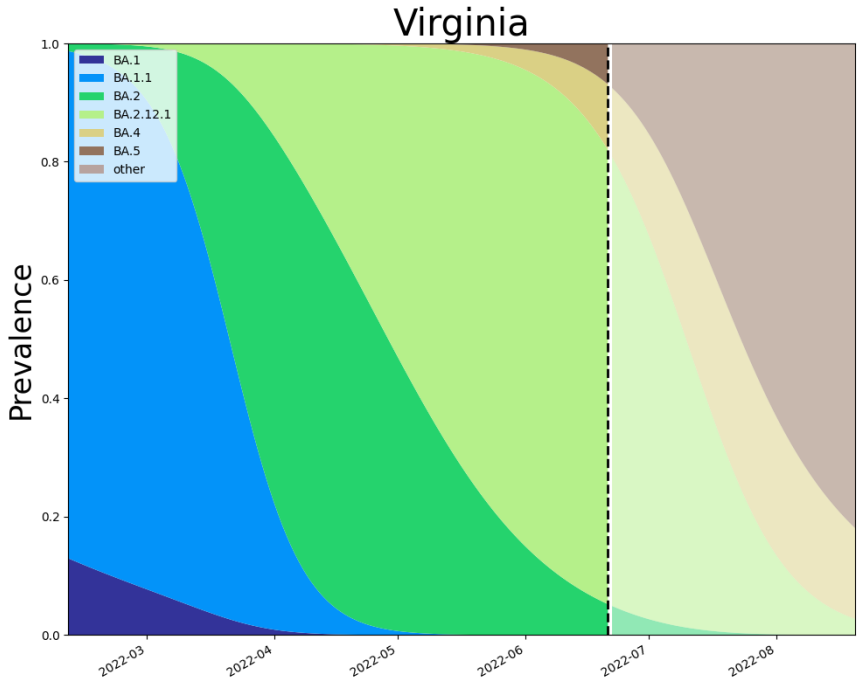
SARS-CoV2 Omicron and Sub-Variants

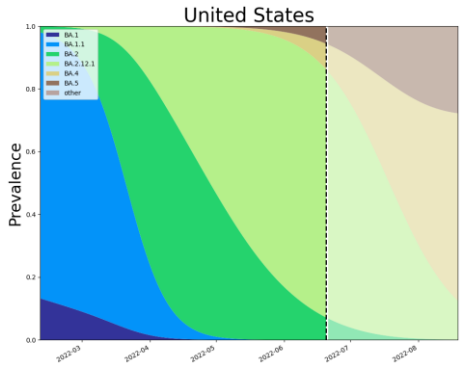
As detected in whole Genomes in public repositories





VoC Polynomial Fit Projections





Note: Data lags force projections to start in past. Everything from dotted line forward is a projection.

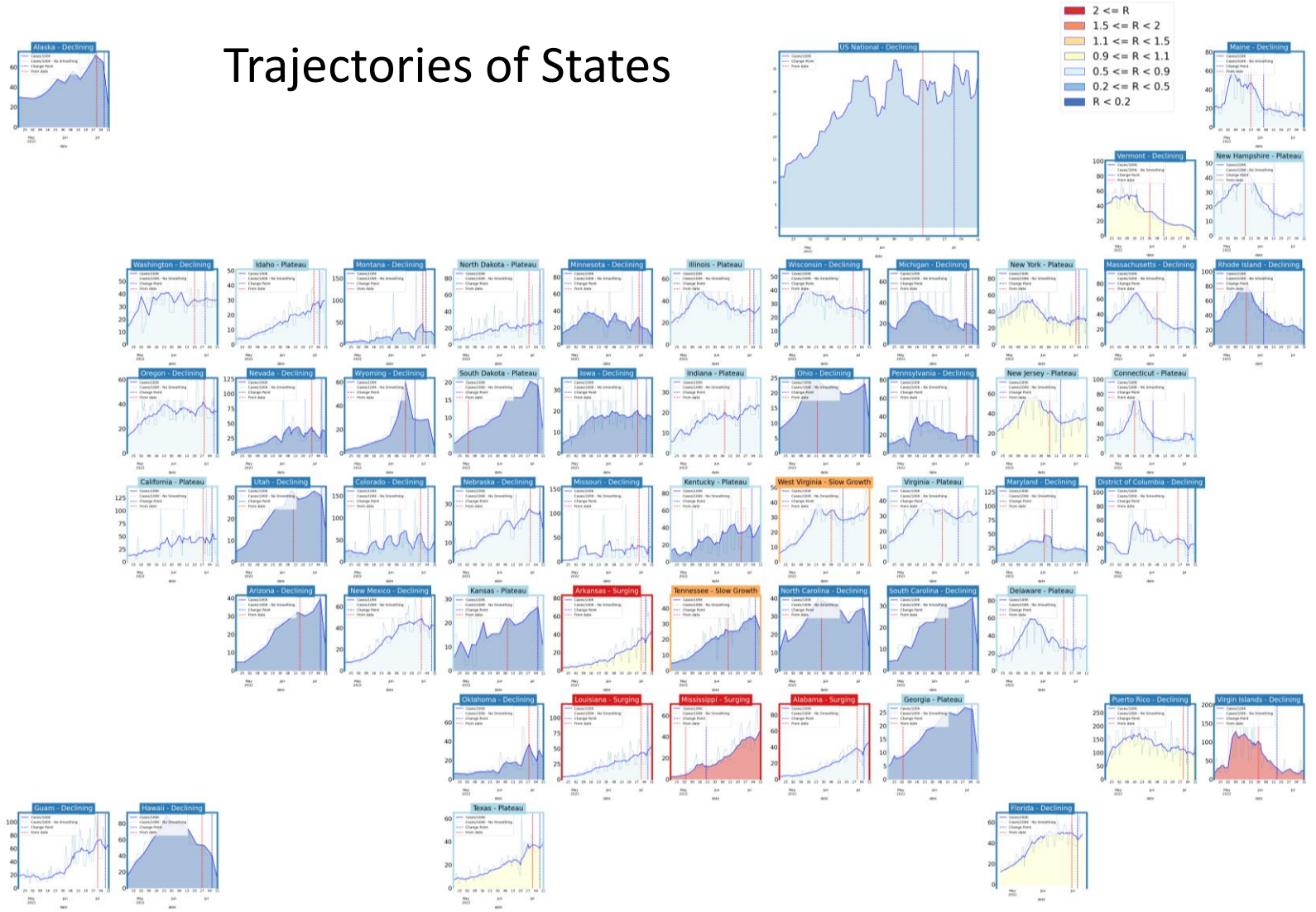
GISAID outbreak.info

United States Case Rates

- Plateauing case rates nationally
- Surge observed in Southwest

Status	# States
Declining	32 (33)
Plateau	16 (12)
Slow Growth	2 (4)
In Surge	4 (5)

Trajectories of States



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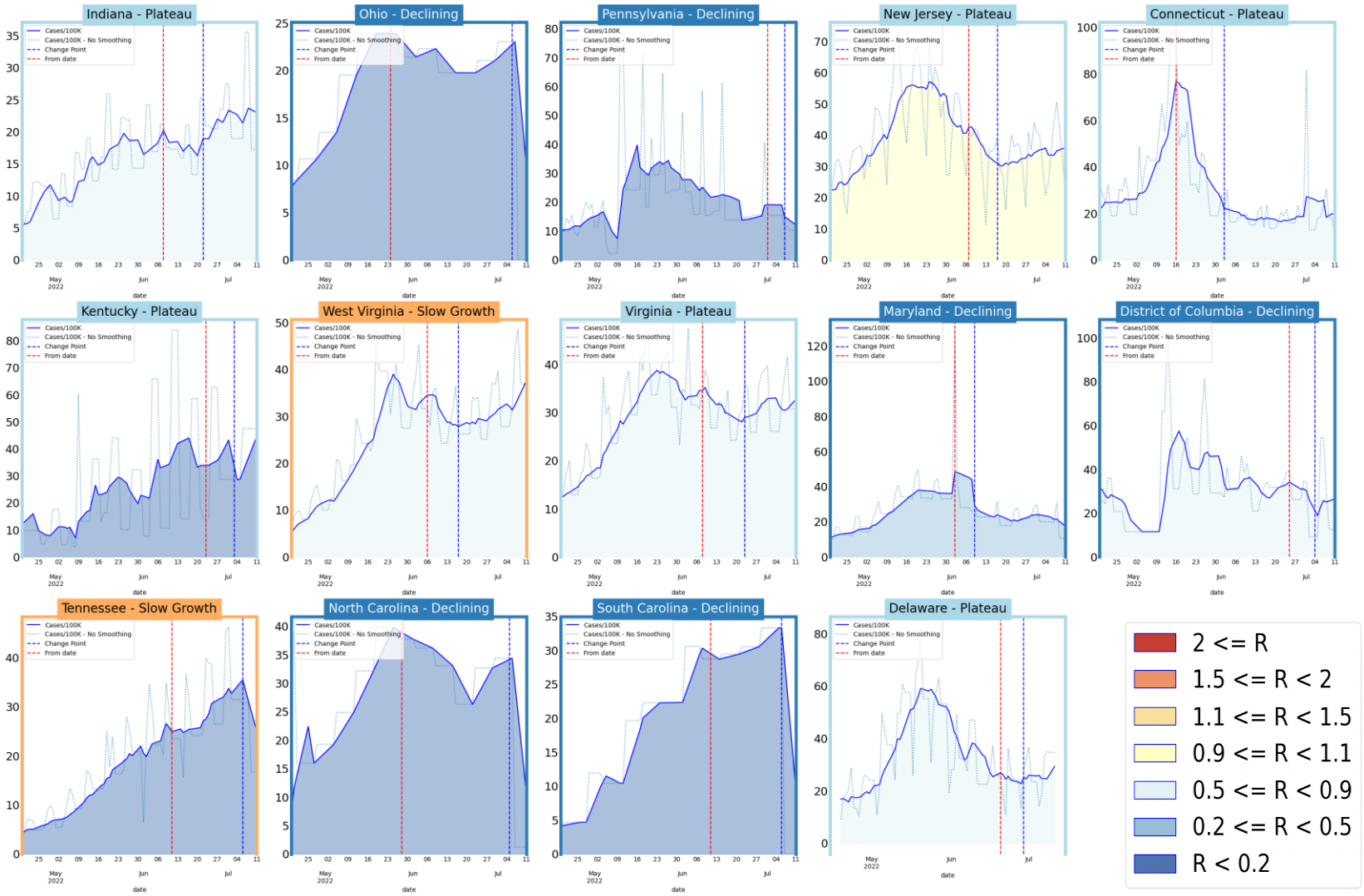
Virginia and Her Neighbors



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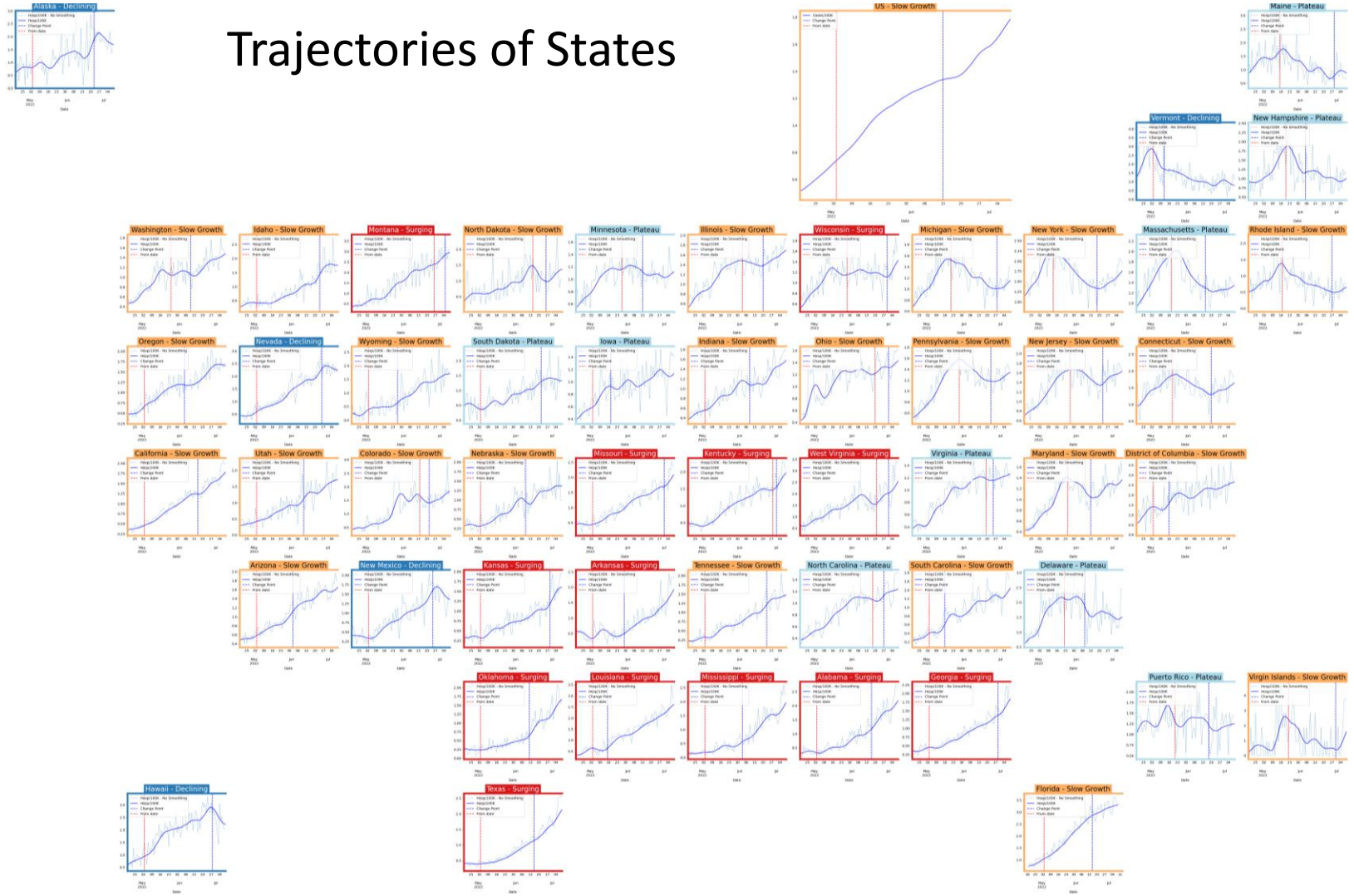
United States Hospitalizations

- Hospital admissions are lagging case rates
- Many states have growing hospitalizations with relatively flat case rates

Status	# States
Declining	5 (5)
Plateau	10 (11)
Slow Growth	25 (27)
In Surge	13 (10)



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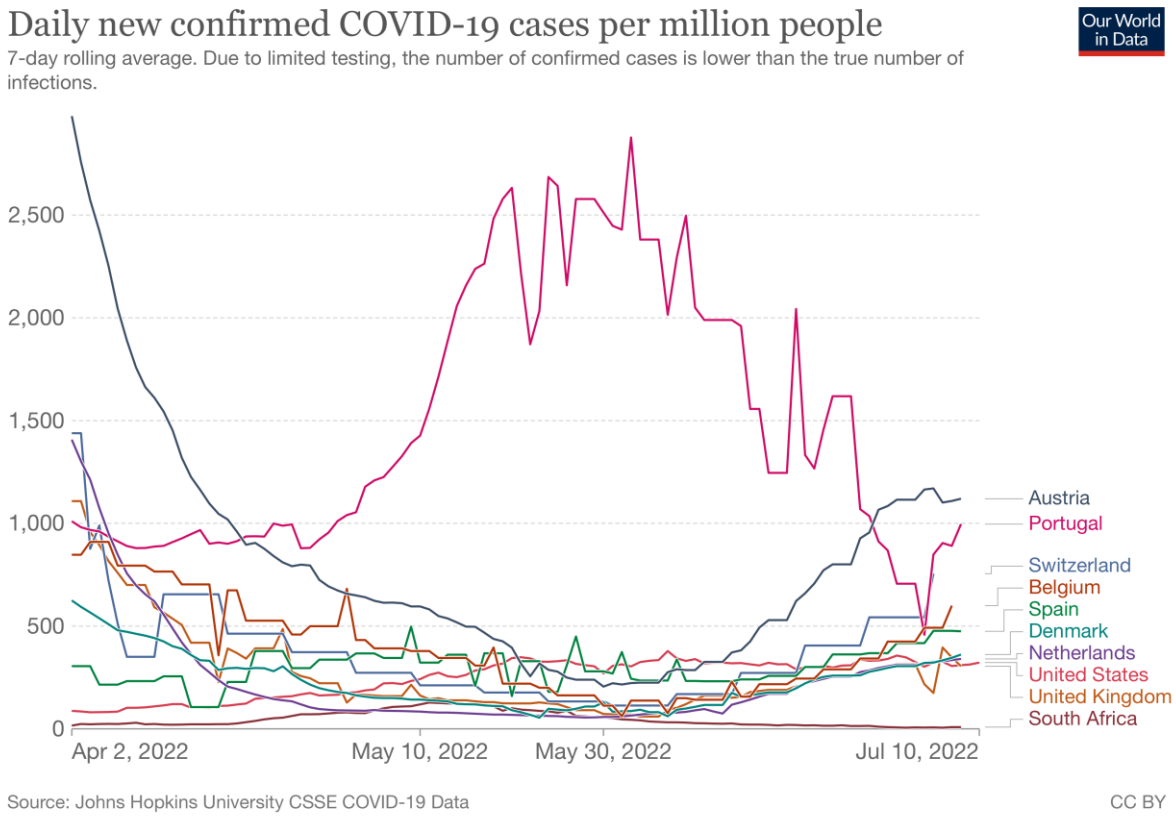
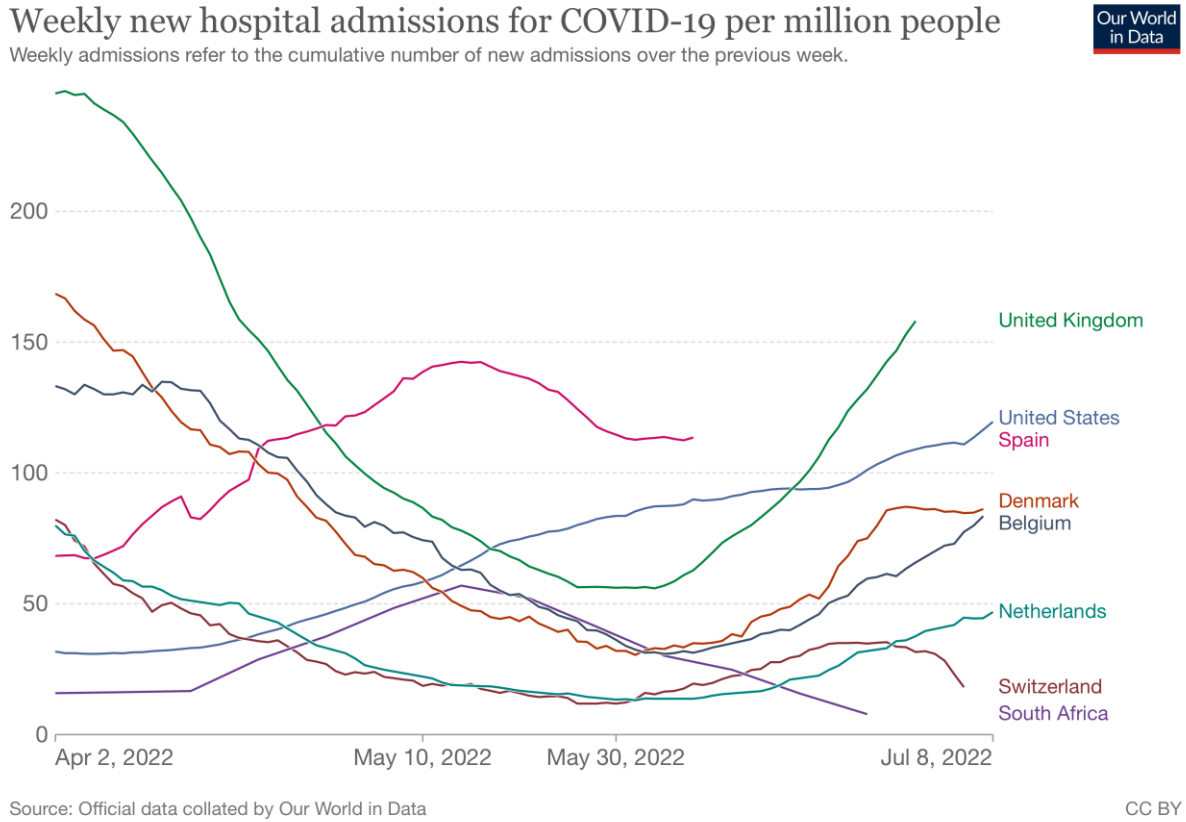
Around the World – BA.4 and BA.5 impacted countries

Confirmed cases

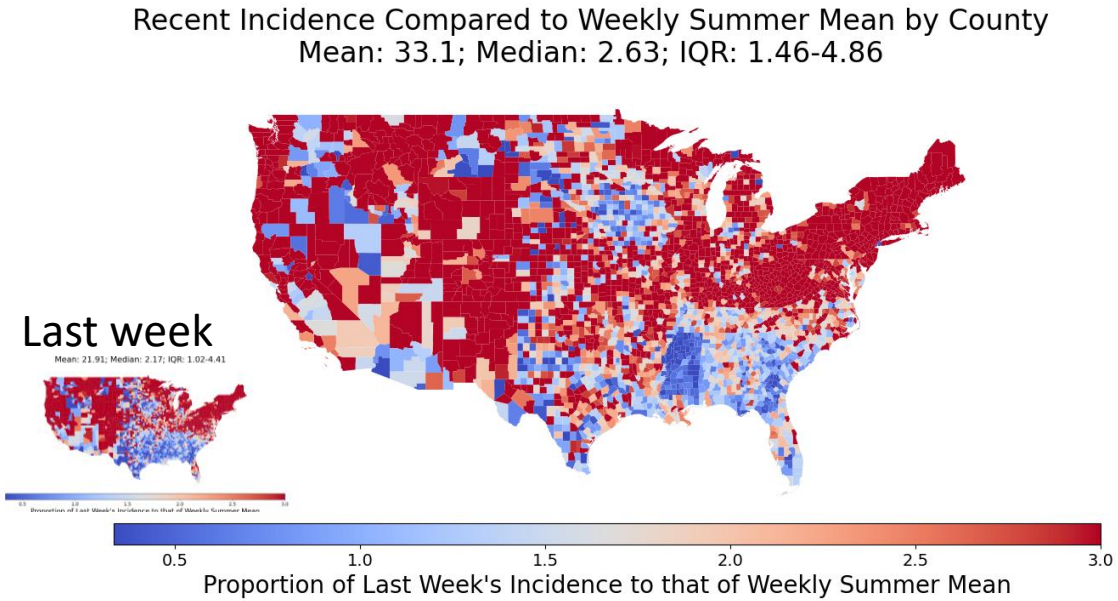


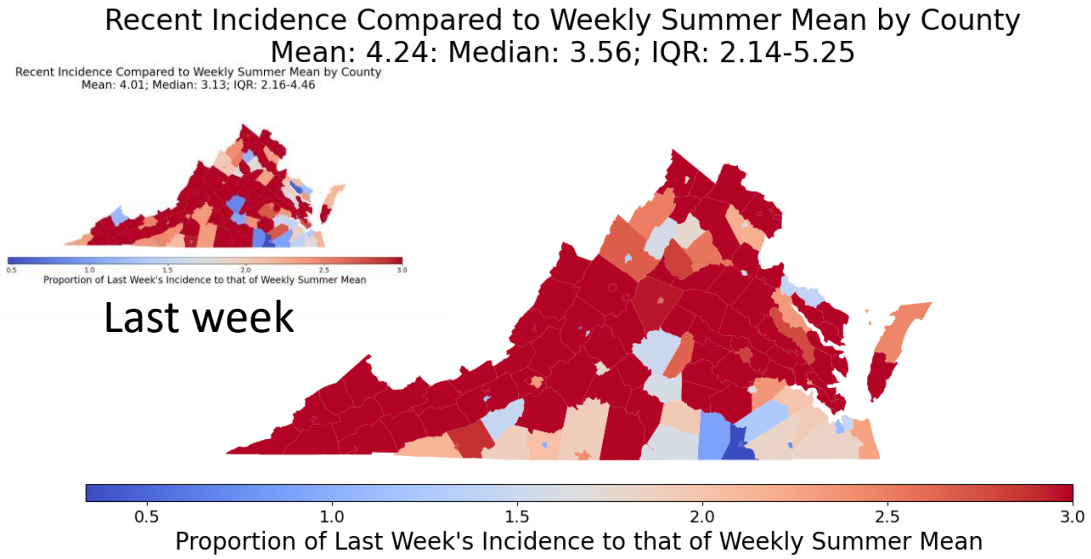
Hospitalizations



[Our World in Data]

County-level comparison to last Summer





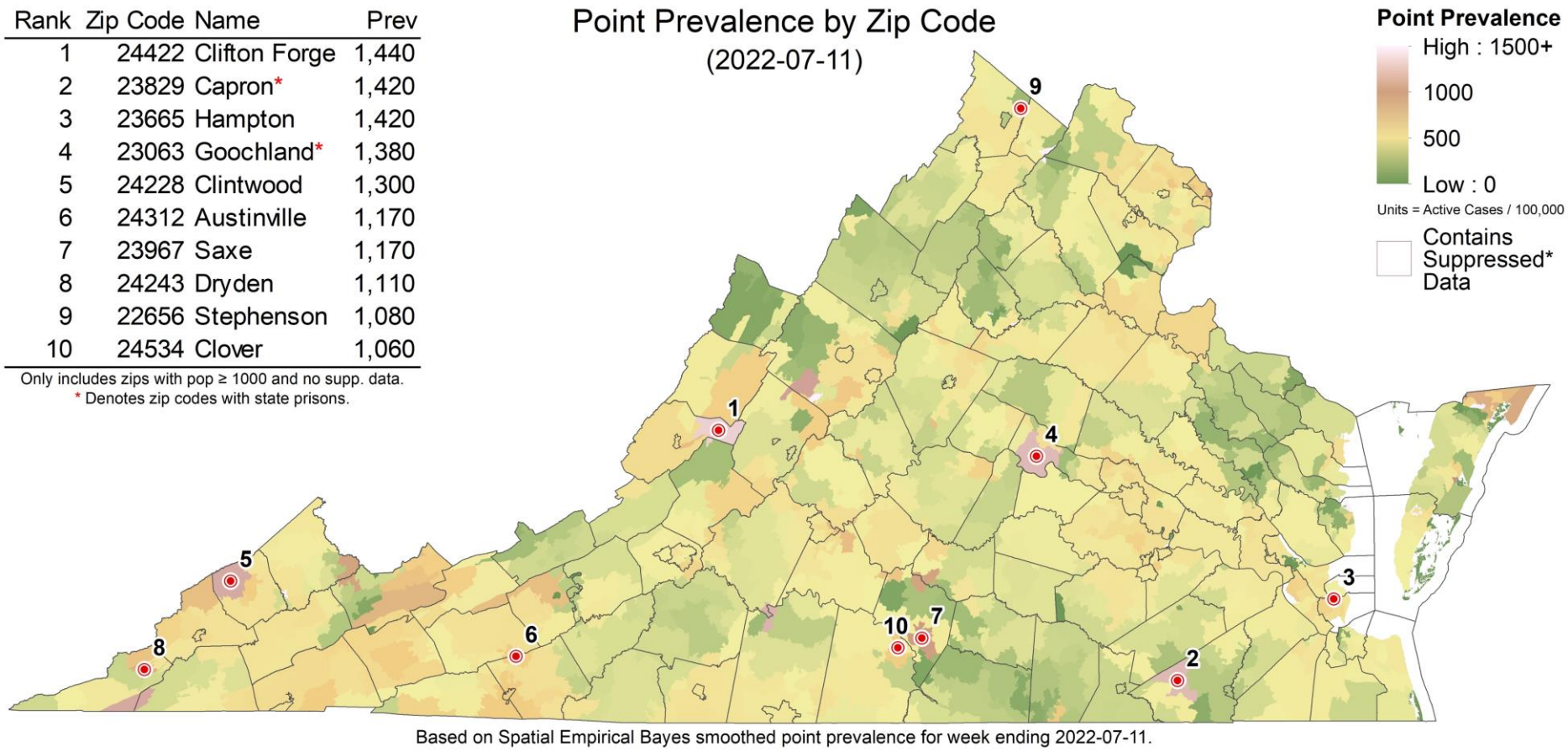
Zip code level weekly Case Rate (per 100K)

Case Rates in the last week by zip code

- Some counts are low and suppressed to protect anonymity, those are shown in white

Rank	Zip Code	Name	Prev
1	24422	Clifton Forge	1,440
2	23829	Capron*	1,420
3	23665	Hampton	1,420
4	23063	Goochland*	1,380
5	24228	Clintwood	1,300
6	24312	Austinville	1,170
7	23967	Saxe	1,170
8	24243	Dryden	1,110
9	22656	Stephenson	1,080
10	24534	Clover	1,060

Only includes zips with pop ≥ 1000 and no supp. data.
* Denotes zip codes with state prisons.



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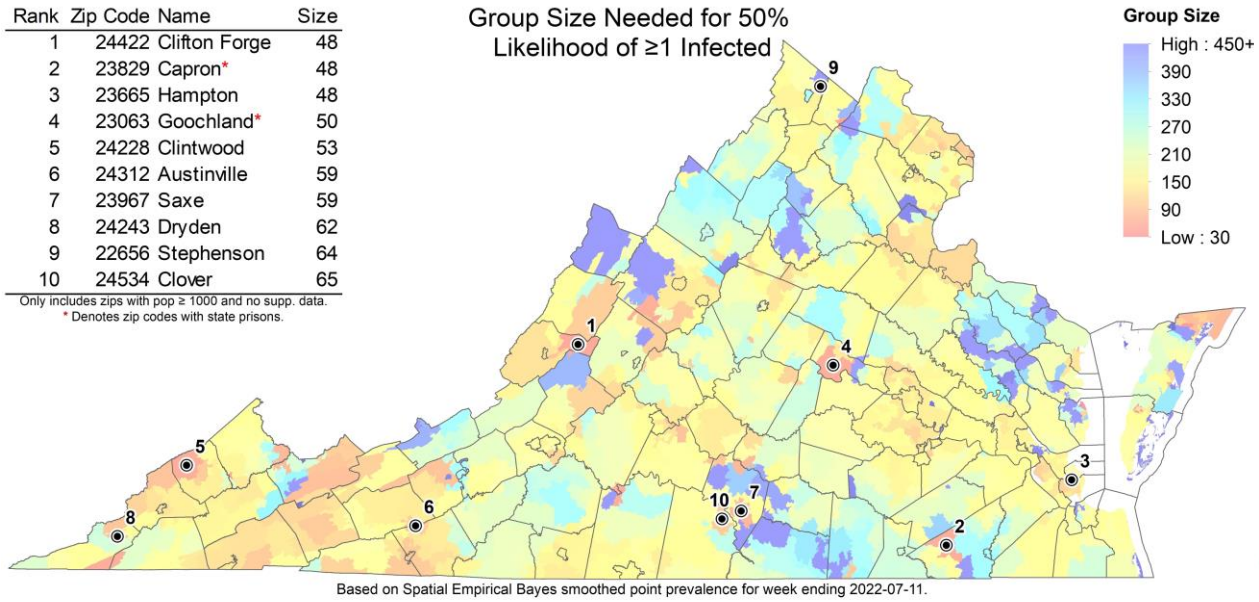
Risk of Exposure by Group Size and HCW prevalence

Case Prevalence in the last week by zip code used to calculate risk of encountering someone infected in a gathering of randomly selected people (group size 25)

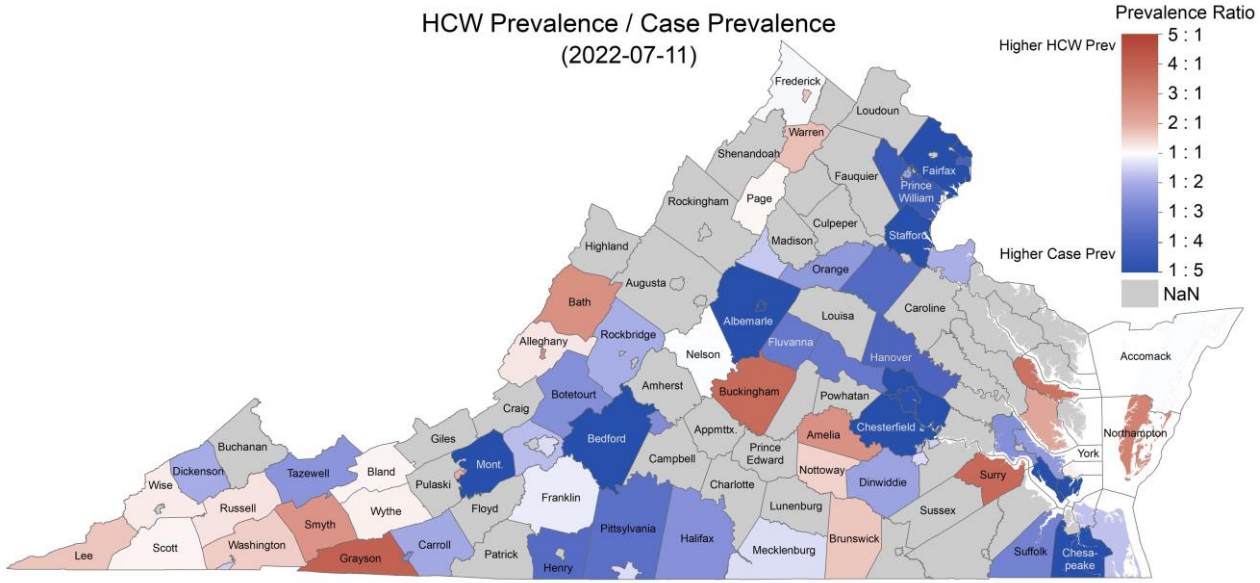
- **Group Size**: Assumes 2 undetected infections per confirmed case (ascertainment rate from recent seroprevalence survey), and shows minimum size of a group with a 50% chance an individual is infected by zip code (eg in a group of 48 in Clifton Forge, there is a 50% chance someone will be infected)
- **HCW ratio**: Case rate among health care workers (HCW) in the last week using patient facing health care workers as the denominator / general population's case prevalence

Rank	Zip Code	Name	Size
1	24422	Clifton Forge	48
2	23829	Capron*	48
3	23665	Hampton	48
4	23063	Goochland*	50
5	24228	Clintwood	53
6	24312	Austinville	59
7	23967	Saxe	59
8	24243	Dryden	62
9	22656	Stephenson	64
10	24534	Clover	65

Only includes zips with pop ≥ 1000 and no supp. data.
* Denotes zip codes with state prisons.



Based on Spatial Empirical Bayes smoothed point prevalence for week ending 2022-07-11.



Current Hot-Spots

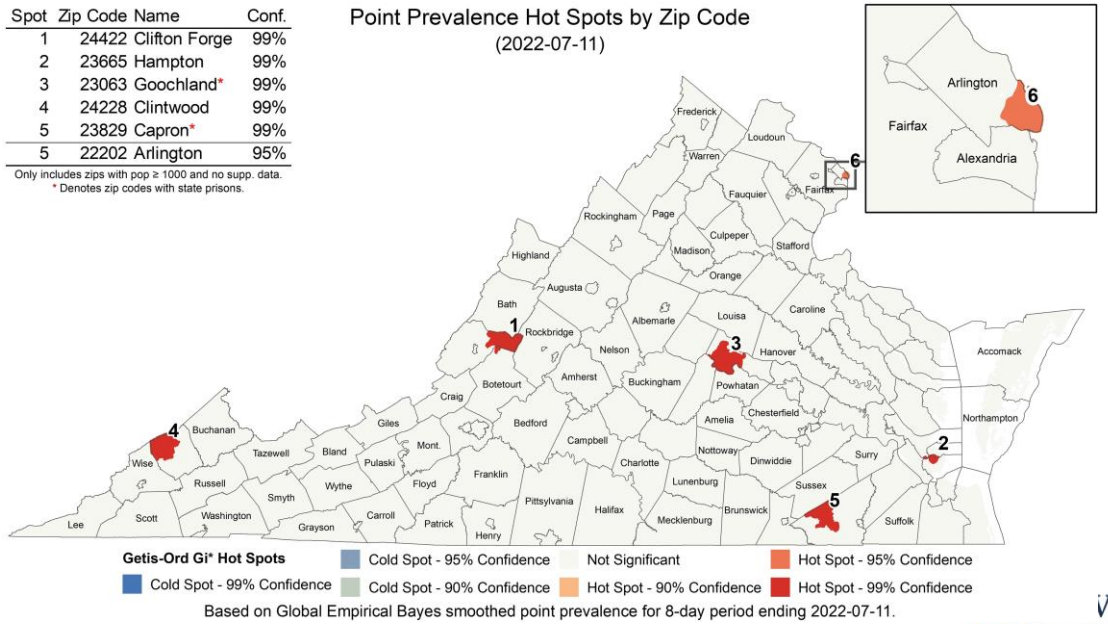
Case rates that are significantly different from neighboring areas or model projections

- **Spatial**: Getis-Ord Gi* based hot spots compare clusters of zip codes with weekly case prevalence higher than nearby zip codes to identify larger areas with statistically significant deviations
- **Temporal**: The weekly case rate (per 100K) projected last week compared to observed by county, which highlights temporal fluctuations that differ from the model's projections

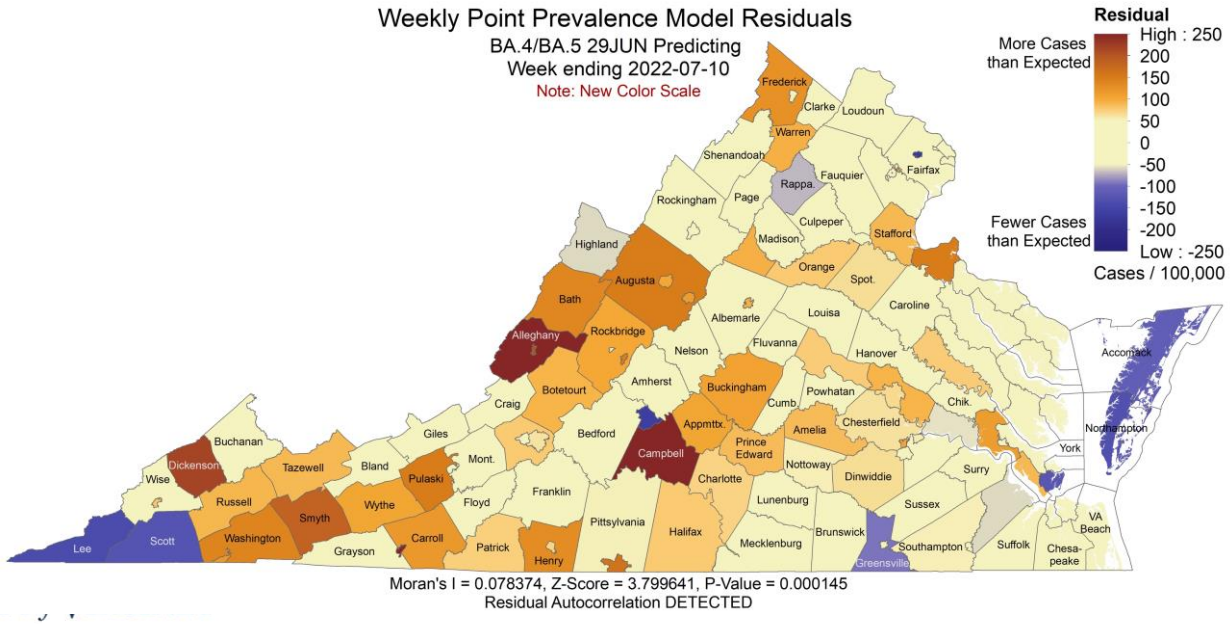
Spatial Hotspots

Spot	Zip Code	Name	Conf.
1	24422	Clifton Forge	99%
2	23665	Hampton	99%
3	23063	Goochland*	99%
4	24228	Clintwood	99%
5	23829	Capron*	99%
5	22202	Arlington	95%

Only includes zips with pop ≥ 1000 and no supp. data.
* Denotes zip codes with state prisons.



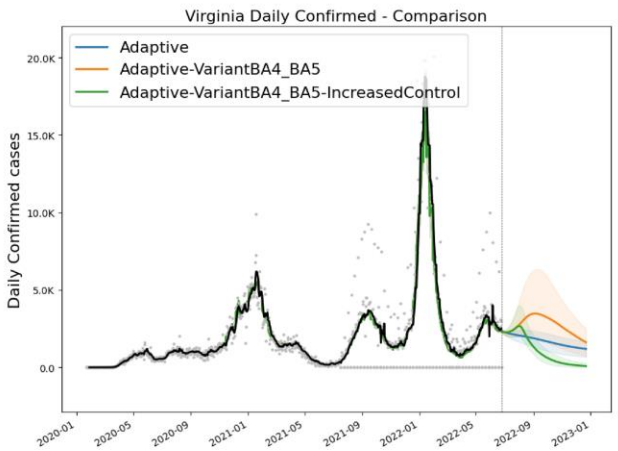
Clustered Temporal Hotspots from BA.4_BA.5



Scenario Trajectory Tracking

Which scenario from last projection did each county track closest?

- Minimal difference between projections overall
- Adaptive scenario underpredicted most counties and better tracked BA.4/5 scenario, but even that scenario underestimated growth

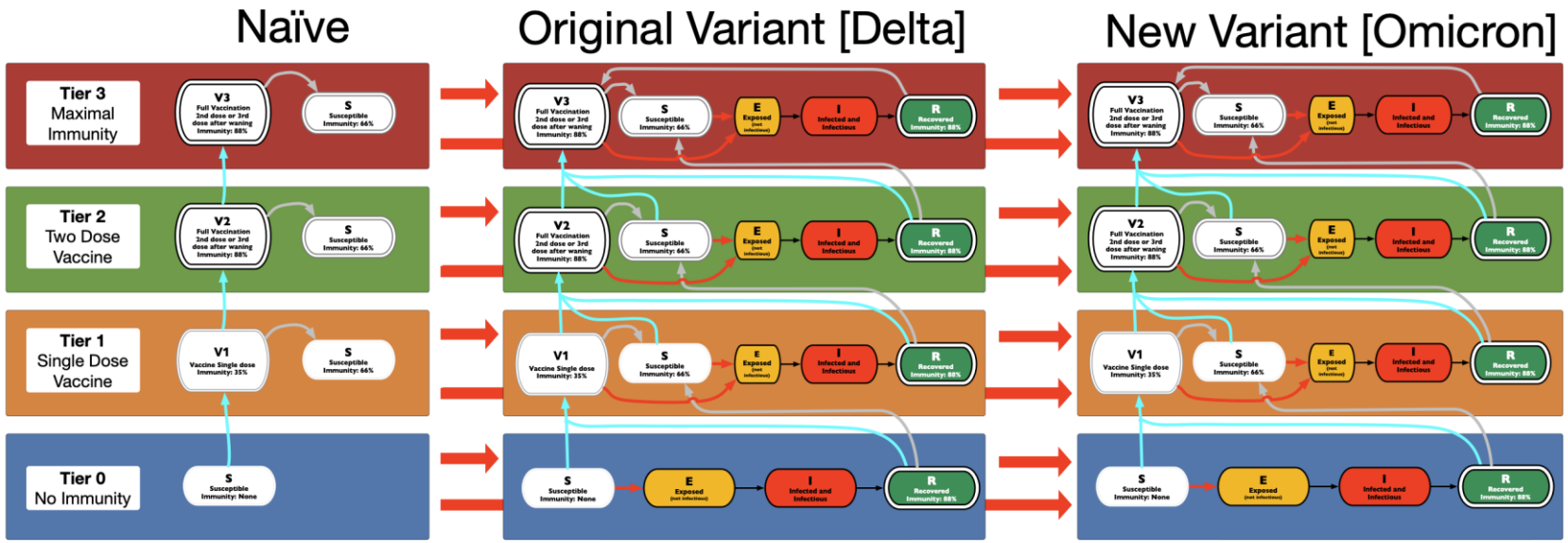


Model Update – Adaptive Fitting

Model Structure Extended for more sub-variants

Omicron sub-variants escape immunity induced by previous sub-variants

- Multiple strain support allows representation of differential protection based on immunological history (BA.1, BA.2, BA.2.12.1, BA.4/5, and future variants (VariantX))
- Each sub-variant has differing levels of immune escape to previous sub-variants, the prevalences are based on observations for fitting purposes, and projections use estimated future prevalences
- Adaptive fitting approach continues to use simulation to generate the full distribution of immune states across the population



Adaptive Fitting Approach

Each county fit precisely, with recent trends used for future projection

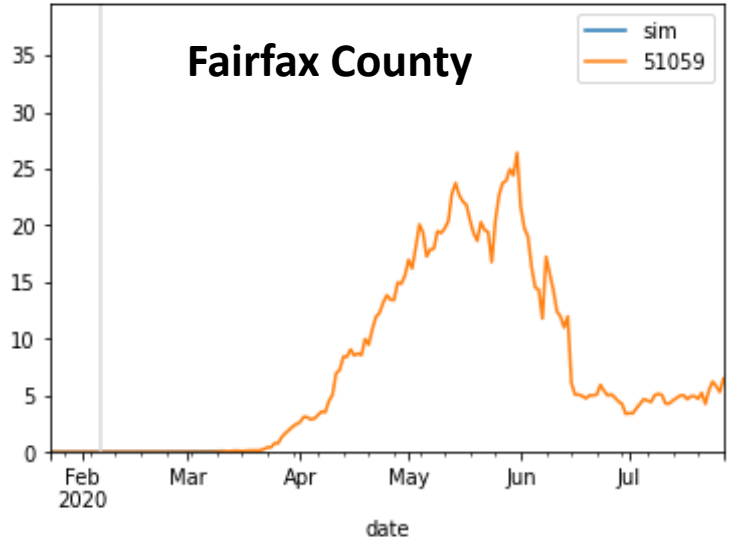
- Allows history to be precisely captured, and used to guide bounds on projections

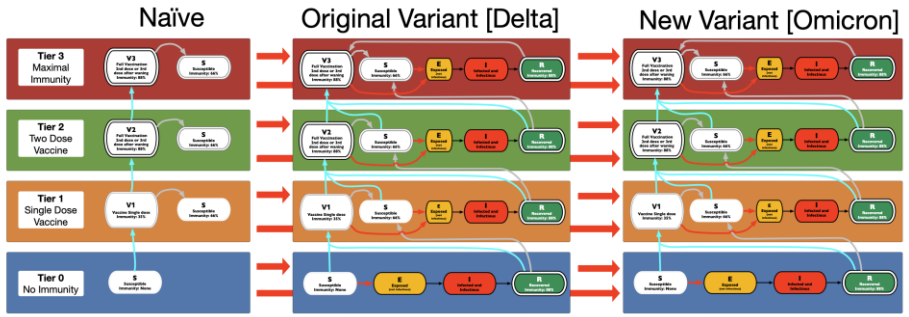
Model: An alternative use of the same meta-population model, PatchSim with multiple tiers of immunity

- Allows for future "what-if" Scenarios to be layered on top of calibrated model
- Allows for waning of immunity and for partial immunity against different outcomes (eg lower protection for infection than death)

External Seeding: Steady low-level importation

- Widespread pandemic eliminates sensitivity to initial conditions, we use steady 1 case per 10M population per day external seeding





Using Ensemble Model to Guide Projections

Ensemble methodology that combines the Adaptive with machine learning and statistical models such as:

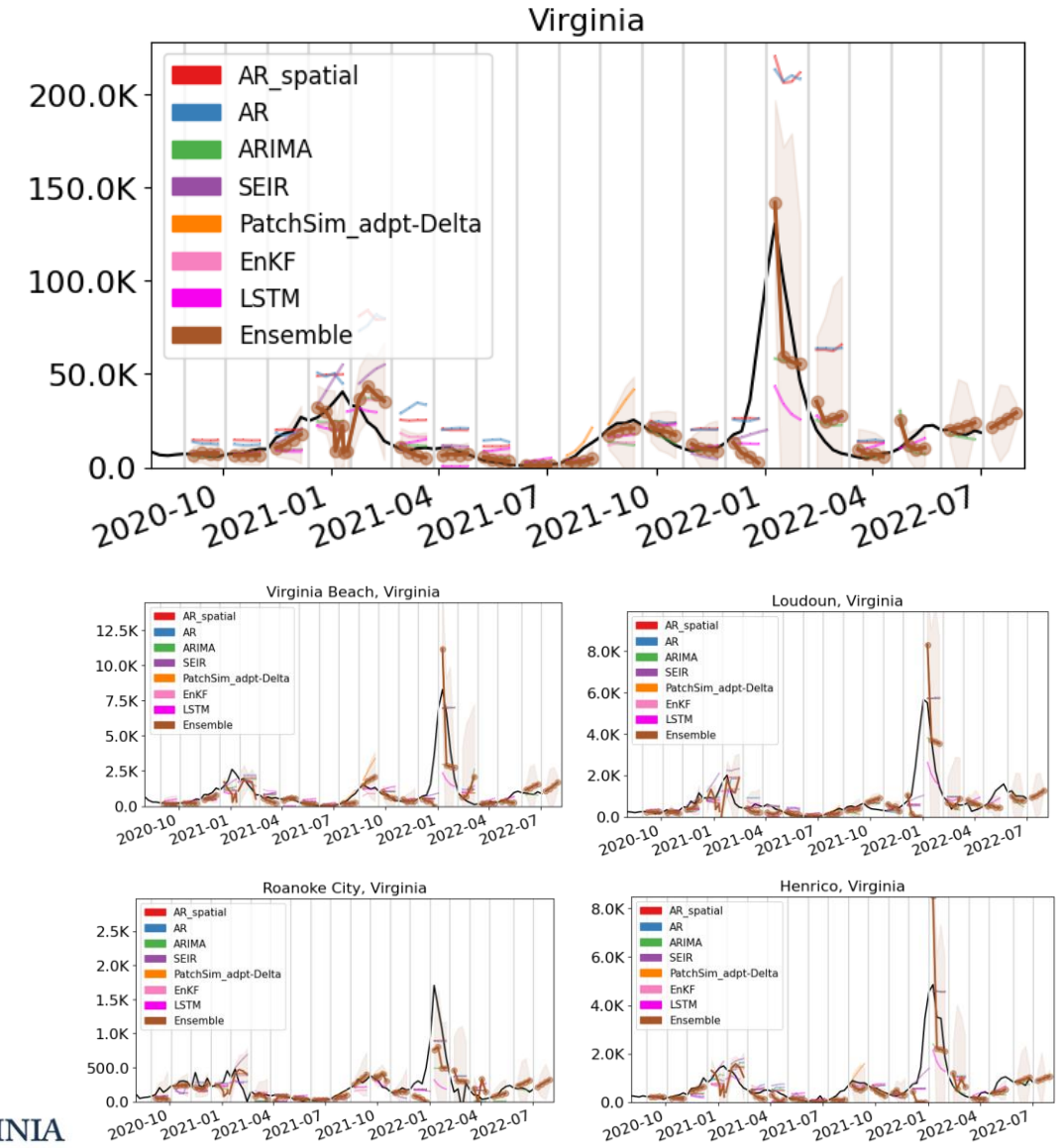
- Autoregressive (AR, ARIMA)
- Neural networks (LSTM)
- Kalman filtering (EnKF)

<u>Weekly forecasts</u> done at county level.

Models chosen because of their track record in disease forecasting and to increase diversity and robustness.

Ensemble forecast provides additional ‘surveillance’ for making scenario-based projections.

Also submitted to CDC Forecast Hub.



Seroprevalence updates to model design

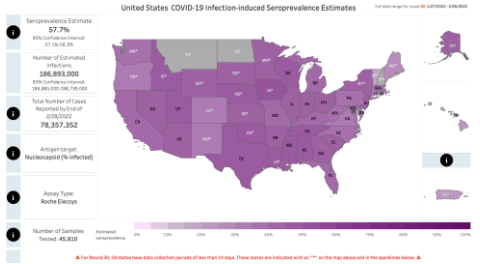
Several seroprevalence studies provide better picture of how many actual infections have occurred

- CDC Nationwide Commercial Laboratory Seroprevalence Survey, however, is no longer reporting updates.

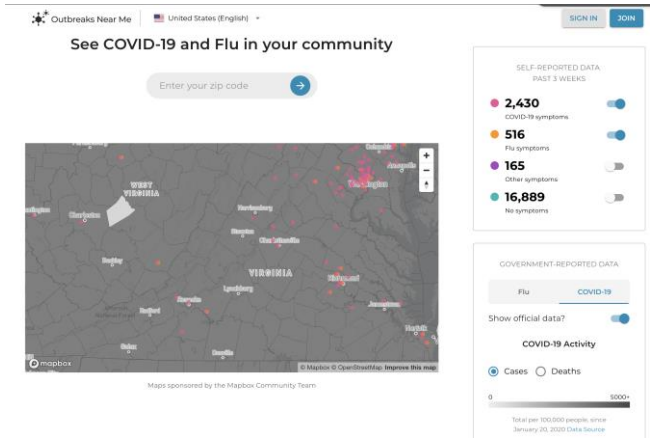
- Pre-Omicron these findings were consistent with an ascertainment ratio of ~2-3x

Testing Behavior has changed, fewer cases are reported

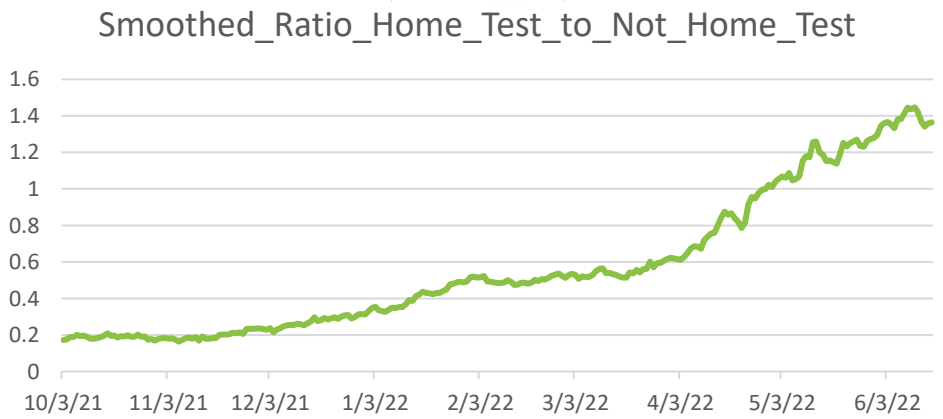
- Home testing, reduced symptoms due to breakthrough / reinfection, and elimination of public health leave
- Outbreaks Near Me from Boston Children's Hospital and Momentive collects reports of home testing
- Accounting for home testing, changes case ascertainment to be 6- 10x



Virginia
Feb 22nd: 45% [42% - 48%];
Jan 22nd: 34% [31%-39%]
https://covid.cdc.gov/covid-data-tracker/#national-lab

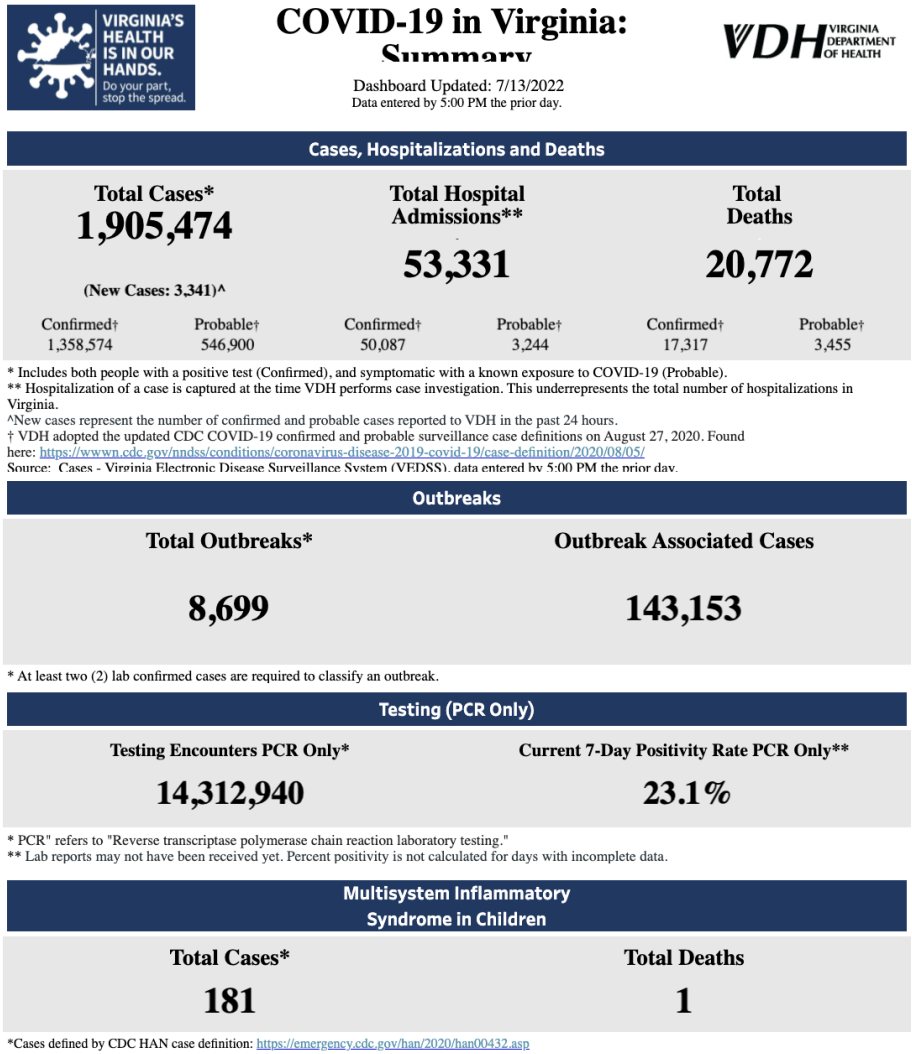


OutbreaksNearMe



Calibration Approach

- **Data:**
  - County level case counts by date of onset (from VDH)
  - Confirmed cases for model fitting
- **Calibration:** fit model to observed data and ensemble's forecast
  - Tune transmissibility across ranges of:
    - Duration of incubation (5-9 days), infectiousness (3-7 days)
    - Undocumented case rate (1x to 7x) guided by seroprevalence studies
    - Detection delay: exposure to confirmation (4-12 days)
  - Approach captures uncertainty, but allows model to precisely track the full trajectory of the outbreak
- **Project:** future cases and outcomes generated using the collection of fit models run into the future
  - **Mean trend from last 7 days of observed cases and first week of ensemble's forecast used**
  - Outliers removed based on variances in the previous 3 weeks
  - 2 week interpolation to smooth transitions in rapidly changing trajectories
- **Outcomes**: Data driven by shift and ratio that has least error in last month of observations
  - Hospitalizations: 3 days from confirmation, 6.8% of cases hospitalized
  - Deaths: 11 days from confirmation, 1.45% of cases die



VIRGINIA'S HEALTH IS IN OUR HANDS. Do your part, stop the spread.

COVID-19 in Virginia: Summary

VDH VIRGINIA DEPARTMENT OF HEALTH

Dashboard Updated: 7/13/2022
Data entered by 5:00 PM the prior day.

Cases, Hospitalizations and Deaths

Total Cases*	Total Hospital Admissions**	Total Deaths
1,905,474	53,331	20,772
(New Cases: 3,341)^		

Confirmed†	Probable†	Confirmed†	Probable†	Confirmed†	Probable†
1,358,574	546,900	50,087	3,244	17,317	3,455

* Includes both people with a positive test (Confirmed), and symptomatic with a known exposure to COVID-19 (Probable).
** Hospitalization of a case is captured at the time VDH performs case investigation. This underrepresents the total number of hospitalizations in Virginia.
^New cases represent the number of confirmed and probable cases reported to VDH in the past 24 hours.
† VDH adopted the updated CDC COVID-19 confirmed and probable surveillance case definitions on August 27, 2020. Found here: https://wwwn.cdc.gov/nndss/conditions/coronavirus-disease-2019-covid-19/case-definition/2020/08/05/
Source: Cases - Virginia Electronic Disease Surveillance System (VEDSS), data entered by 5:00 PM the prior day.

Outbreaks

Total Outbreaks*	Outbreak Associated Cases
8,699	143,153

* At least two (2) lab confirmed cases are required to classify an outbreak.

Testing (PCR Only)

Testing Encounters PCR Only*	Current 7-Day Positivity Rate PCR Only**
14,312,940	23.1%

* PCR" refers to "Reverse transcriptase polymerase chain reaction laboratory testing."
** Lab reports may not have been received yet. Percent positivity is not calculated for days with incomplete data.

Multisystem Inflammatory Syndrome in Children

Total Cases*	Total Deaths
181	1

*Cases defined by CDC HAN case definition: https://emergency.cdc.gov/han/2020/han00432.asp

Accessed 9:00am July 13, 2022
https://www.vdh.virginia.gov/coronavirus/

Scenarios – Transmission Conditions

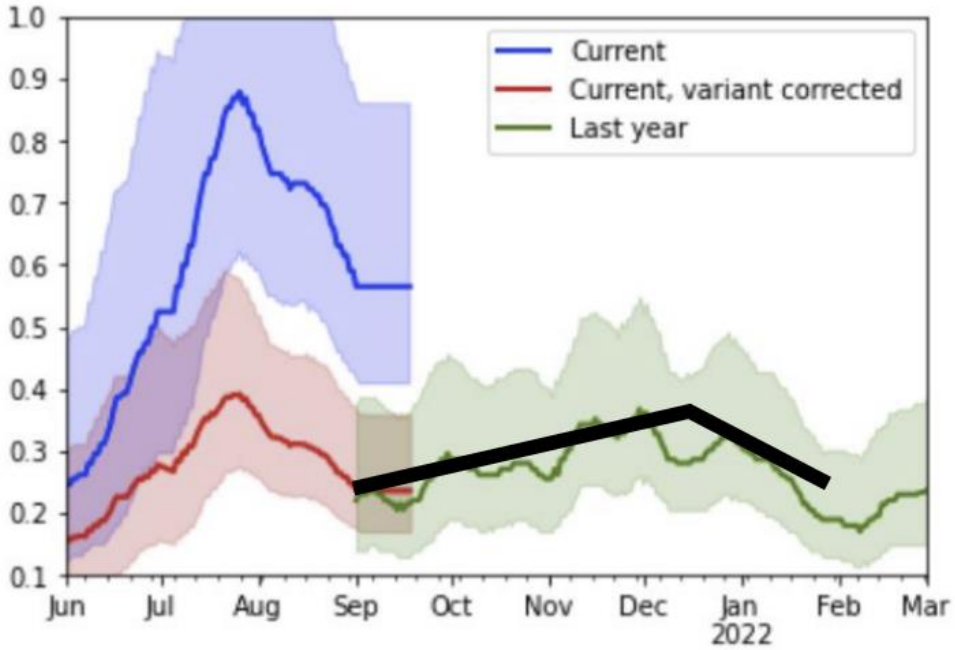
- Variety of factors continue to drive transmission rates
  - Seasonal impact of weather patterns, travel and gatherings, fatigue and premature relaxation of infection control practices
- **Waning Immunity**: Omicron waning with a mean of 4 months
- **Projection Scenarios**:
  - **Adaptive:** Control remains as is currently experienced into the future with assumption that most recent rapidly growing subvariant (BA.4/5) has already grown to substantial level and future growth will not drive further growth
  - **Adaptive-FallWinter:** Controls remain the same, however, seasonal forcing similar to past Fall-Winter waves is added on from Sept-Feb
  - **Adaptive-VariantX**: Speculative scenario that assumes a new sub-variant with similar immune escape but no transmission advantage emerges 3 months after the last significant sub-variant and grows at a similar rate
  - **Adaptive-VariantX-FallWinter:** Same as Adaptive-VariantX but with the seasonal forcing of FallWinter added on as well

Scenarios – FallWinter

September – February saw strong waves of transmission for both years

- Based on analyses of the past 2 seasons we generate a “coarse baseline transmission boost”
  - In 2021 the distribution of fitted model transmissibility was nearly identical between these periods when corrected for Delta’s increased transmissibility
- **FallWinter** captures these “transmission drivers” from the past and use them as if they were to occur again this season

Fitting:
Black line represents the coarsely fitted base transmissibility



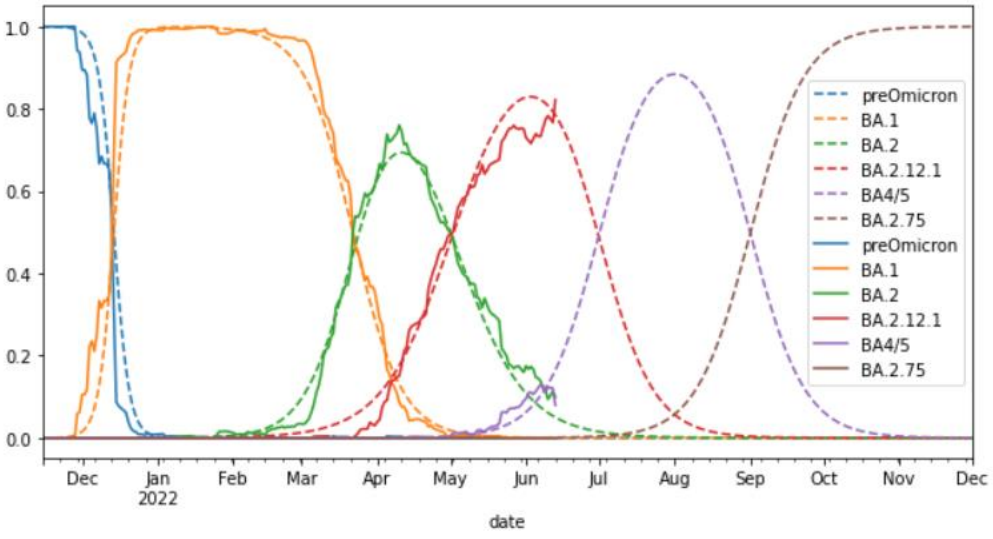
* “Last year” is transplanted into 2021-22

Scenarios – Variant X

Omicron sub-variants seem to be emerging and then dominating with some regularity

- ECDC currently monitoring BA.2 + L452X a VOI and BA.3 and BA.2.75 as VUM, all have been detected in Europe
- Hypothetical future sub-variant, VariantX, may continue the pattern. Assumes similar growth and level of immune escape against previous sub-variants as BA.4/5 (same transmissibility and 30% immune escape against BA.4/5, higher for other sub-variants)

Sub-Variants with Fitted Prevalences and Hypothetical Future waves



Variants of Interest

WHO label	Lineage + additional mutations	Country first detected (community)	Spike mutations of interest	Year and month first detected	Impact on transmissibility	Impact on immunity	Impact on severity	Transmission in EU/EEA
Omicron	BA.2 + L452X (x)	n/a	L452X	n/a	No evidence	Increased (13)	No evidence	Detected (a)

Variants under Monitoring

Omicron	BA.3	South Africa	(z)	November 2021	No evidence	No evidence	No evidence	Detected (a)
Omicron	BA.2.75 *	India	(w)	May 2022	No evidence	No evidence	No evidence	Detected (a)

[ECDC Variants of Concern]

* BA.2.75 has been miscategorized for sequences that are really 2.73; in essence it is early days of this emergence for now consider BA.2.7x may be the general family of subvariants that are emerging

Projection Scenarios – Combined Conditions

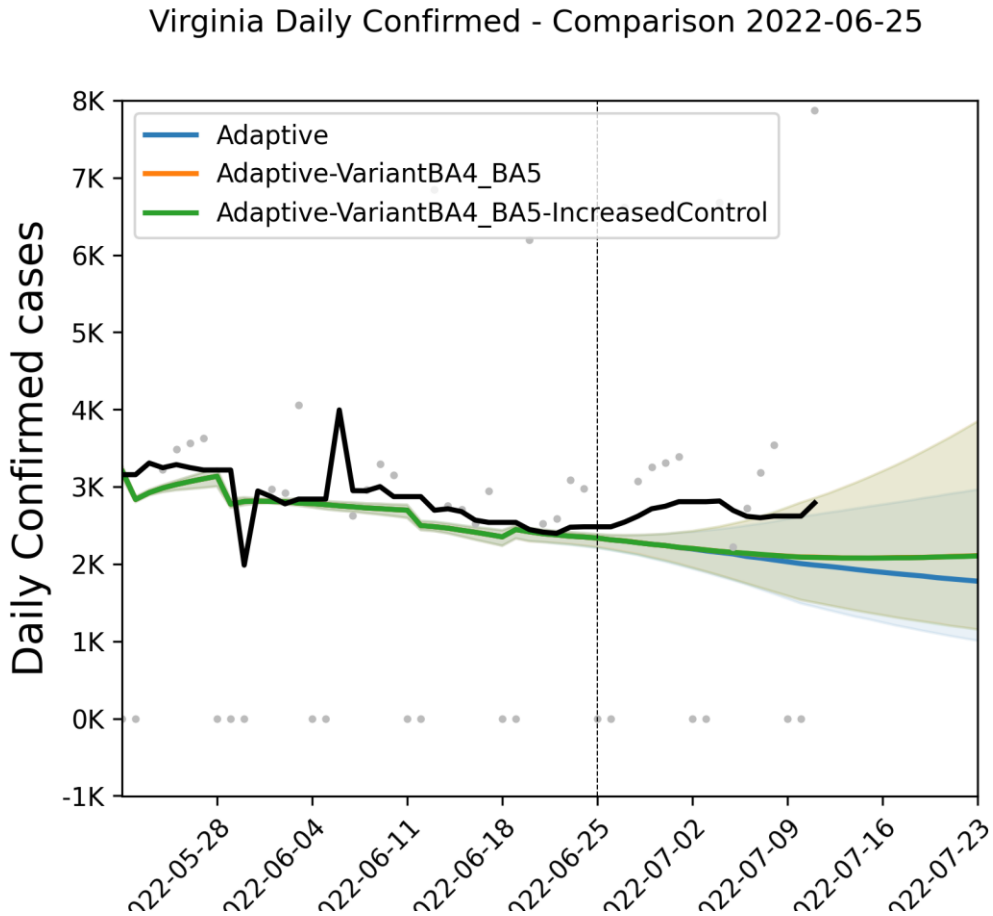
Name	Txm	Variant	Description
Adaptive	C	SQ	Likely trajectory based on conditions remaining similar to the current experience, includes immune escape due to Omicron
Adaptive-FallWinter	FallWinter	SQ	Like Adaptive, with seasonal forcing of FallWinter added on
Adaptive-VariantX	C	X	Like Adaptive, with emergence of a speculative unknown variant 3 months after BA.4/5 with similar level of immune escape and equal transmissibility
Adaptive-VariantX-FallWinter	FallWinter	X	Like Adaptive-VariantX but with the seasonal force of FallWinter added on

Transmission:
C = Current levels persist into the future
Increased = Transmission rates are reduced by 25% over 2 weeks starting May 1st
FallWinter = Transmission rates learned from Sept through February of past seasons are estimated and added as a seasonal boosting to baseline transmission rates

Variant:
SQ = Status quo of current transmission driver from BA.5 remains the same (eg already significantly past dominance, thus no significant majore driving of transmission anticipated)
X = Speculative novel sub-variant scenario, were next variant (eg BA.2.75) emerges 3 months after current with similar levels of immune escape

Last projection comparison – 2 weeks ago

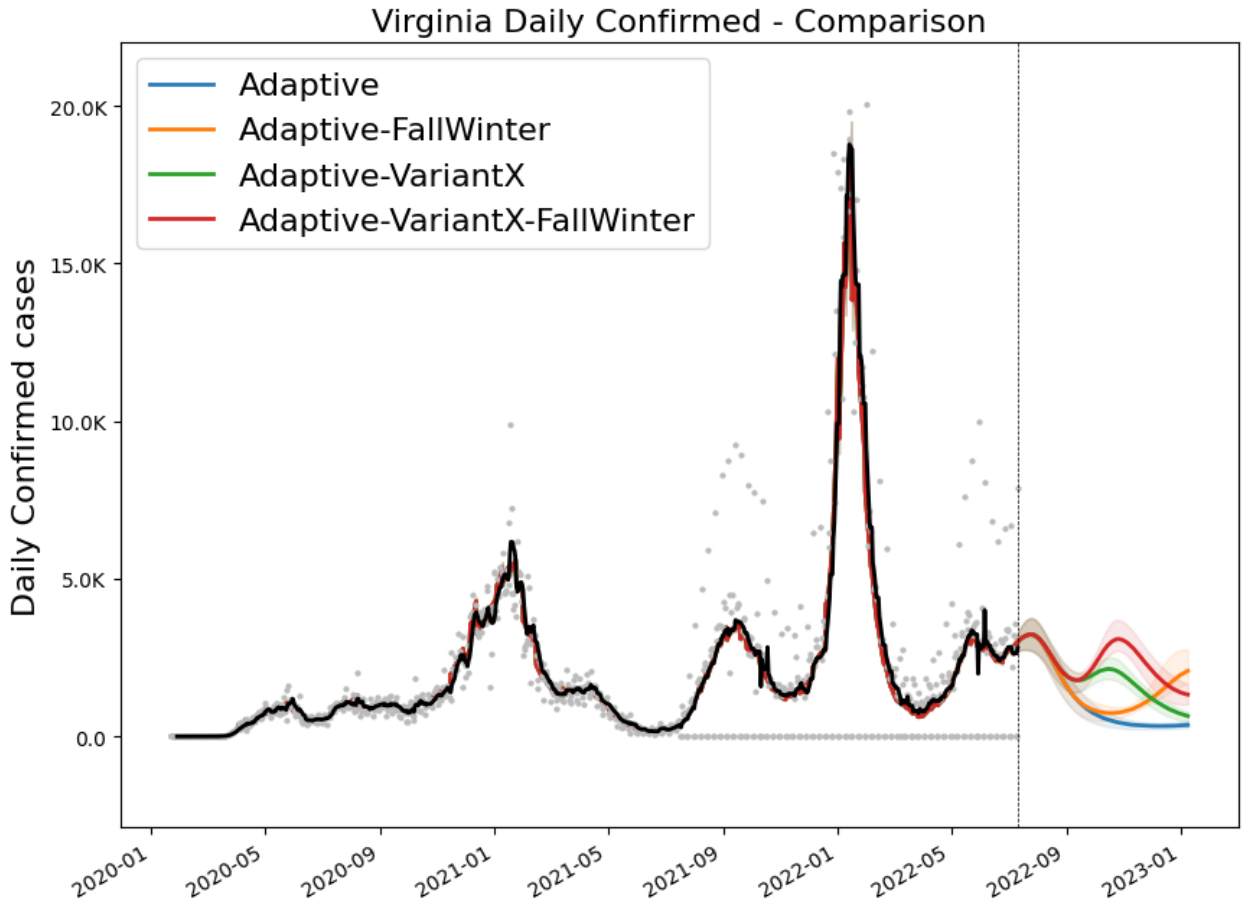
- Projection from 2 weeks ago anticipated gentle decline with BA.4/5 flattening out in a couple weeks, observations indicate a bit more growth driven from BA.4/5 yet with similar qualitative behavior



Model Results

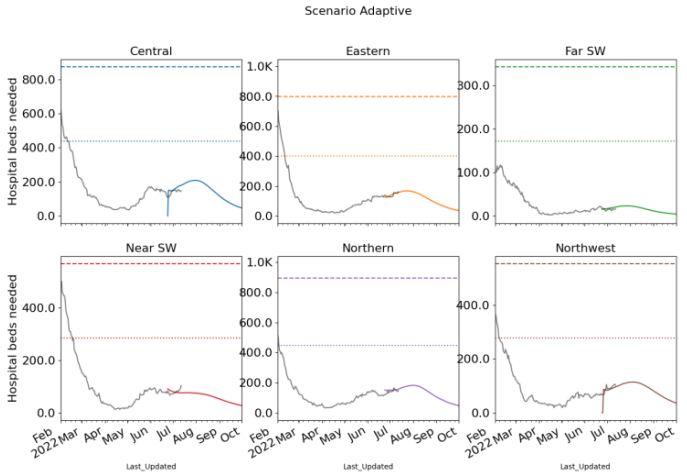
Outcome Projections

Confirmed cases

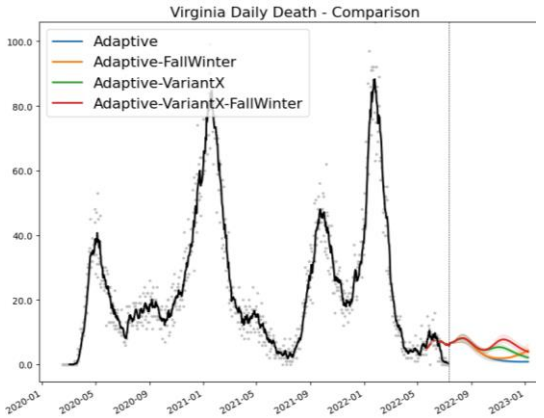


* without surveillance correction VariantBA2 peaked over 10K in July

Estimated Hospital Occupancy

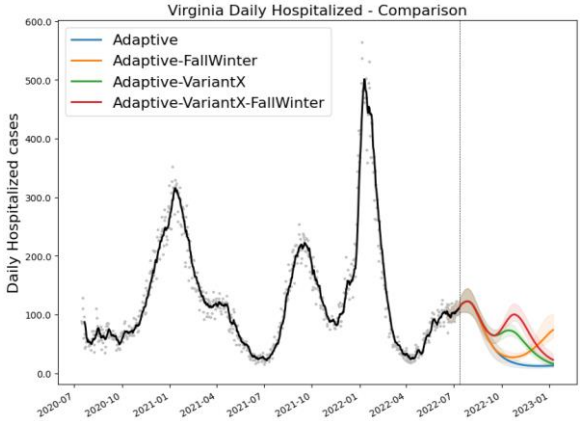


Daily Deaths



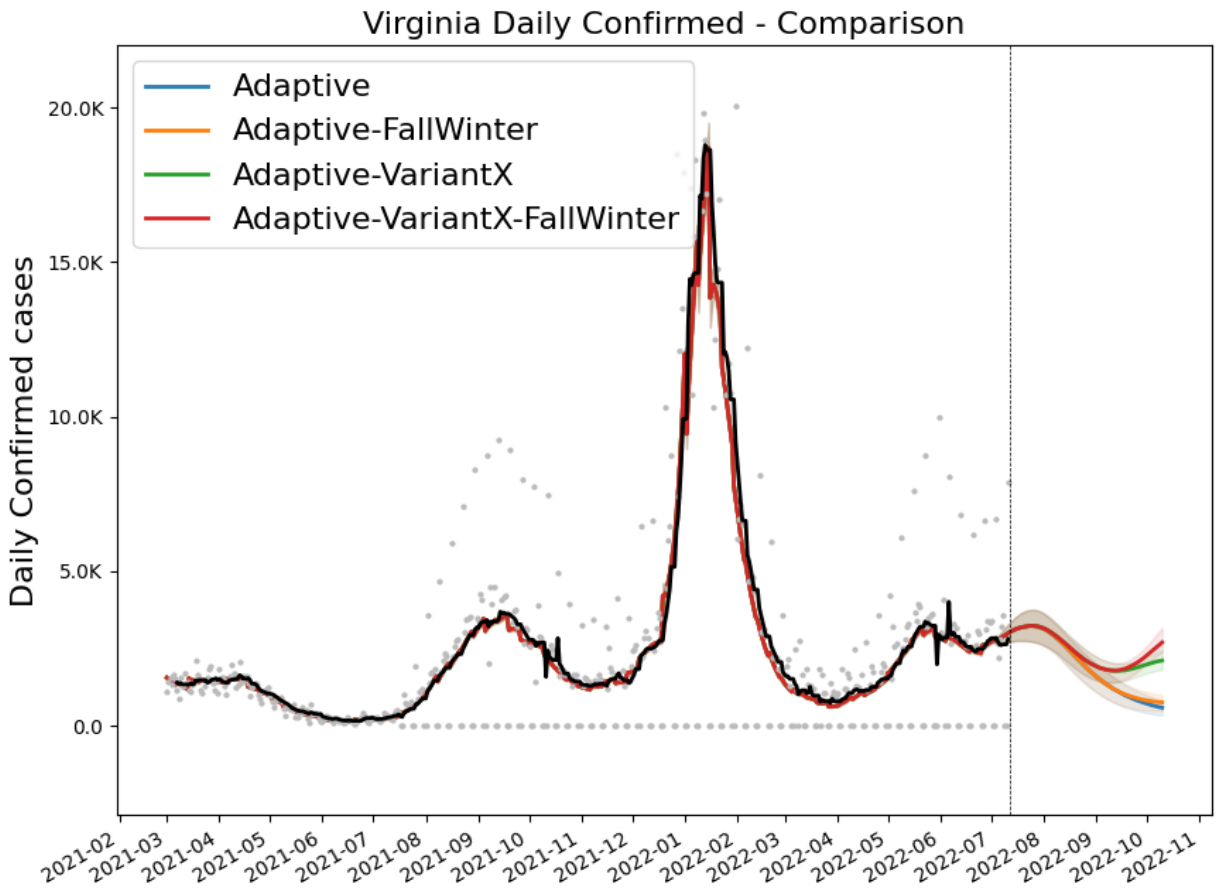
Death ground truth from VDH "Event Date" data, most recent dates are not complete

Daily Hospitalized



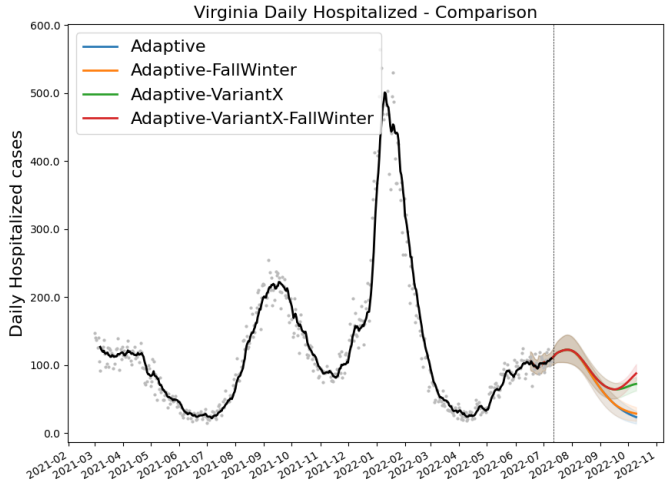
Outcome Projections – Closer Look

Confirmed cases

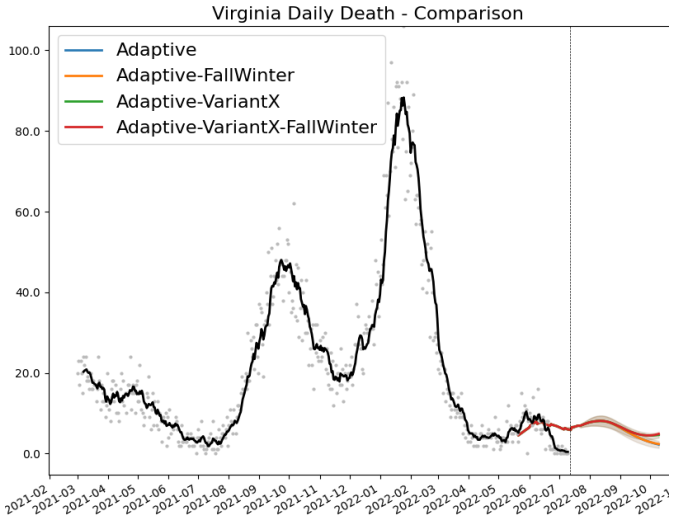


* without surveillance correction VariantBA2 peaked over 10K in July

Daily Hospitalized



Daily Deaths

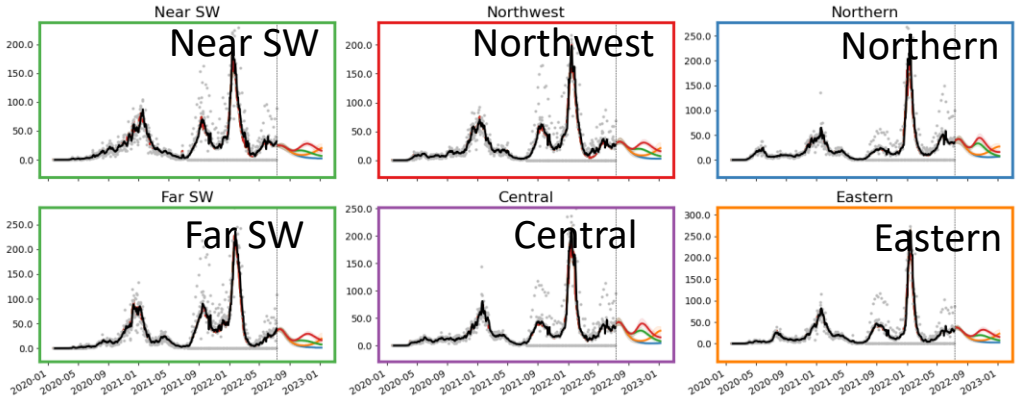


Death ground truth from VDH "Event Date" data, most recent dates are not complete

UNIVERSITY of VIRGINIA
BIOCOMPLEXITY INSTITUTE

Detailed Projections: All Scenarios

Projections by Region

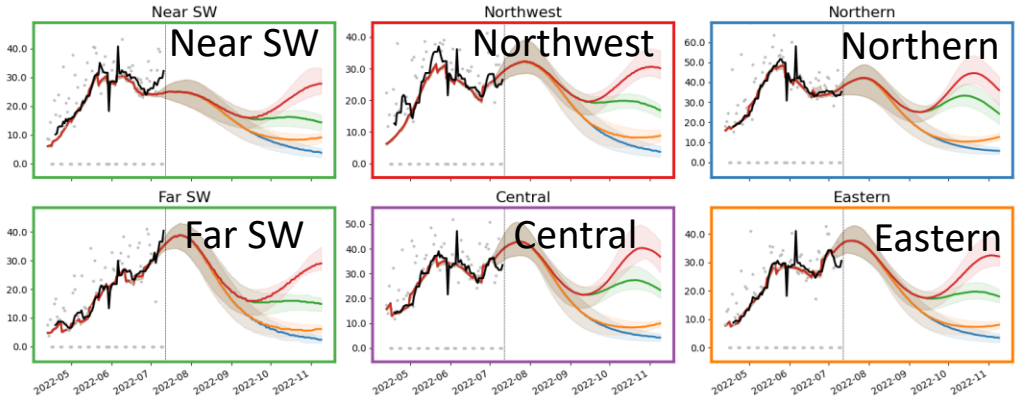


Projections by District

Daily confirmed cases) by rate (per 100K) District (grey with 7-day average in black) with simulation colored by scenario

Detailed Projections: All Scenarios - Closer Look

Projections by Region



Projections by District

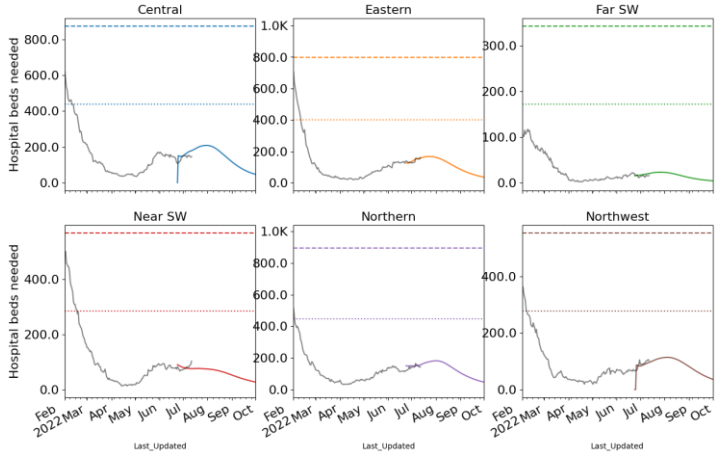
Daily confirmed cases by rate (per 100K) District (grey with 7-day average in black) with simulation colored by scenario

Hospital Demand and Bed Capacity by Region

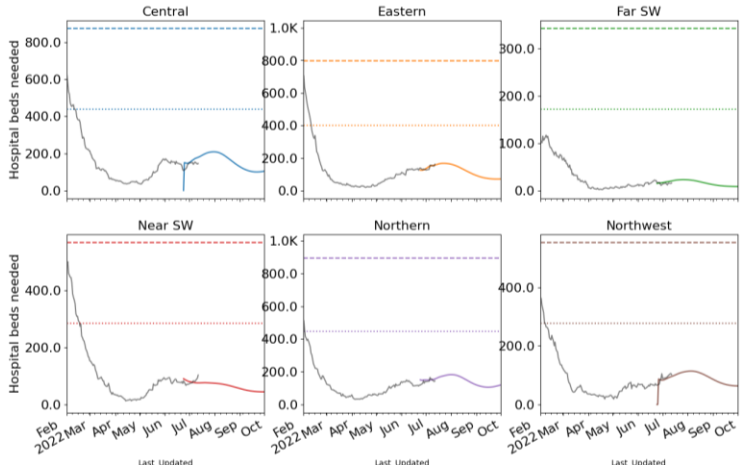
Capacities by Region

COVID-19 capacity ranges from 80% (dots) to 120% (dash) of total beds

Adaptive



Adaptive – VariantX



Length of Stay more variable with Omicron, occupancy projections may vary as a result, ad-hoc estimation performed per region

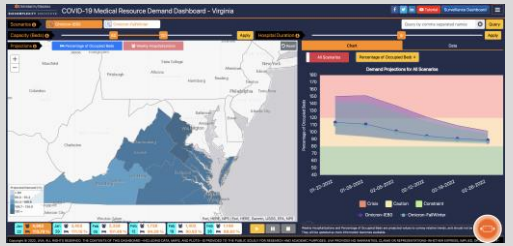
Estimated LOS lengthened slightly to better fit observed data

Projections show continued declines and with expanded capacities and adjusted length of stay, no capacities exceeded

Length of Stay Estimates

Central	9
Eastern	6
Far SW	4
Near SW	8
Northern	4
Northwestern	10

Interactive Dashboard with regional projections



https://nssac.bii.virginia.edu/covid-19/vmrddash/

Key Takeaways

Projecting future cases precisely is impossible and unnecessary.
Even without perfect projections, we can confidently draw conclusions:

- **Case rates affected by holiday week, but are rising at steady pace as are hospitalizations**
- VA weekly case rate up to 242/100K from 221/100K
  - US also up to 250/100K from 218/100K
  - VA hospital occupancy (rolling 7 day mean of 641) has continued to rise
- Projections anticipate growth in short-term, potential for future growth driven by future sub-variants
- Model updates:
  - BA.5 is now dominate strain and measure growth is now folded into Adaptive scenario
  - Further extended to model to represent additional strains independently during the fitting process, now has separate strains for Omicron BA.1, BA.2, BA.2.12.1, BA.4/5, and future variants (VariantX)
  - Home testing adjustment to case ascertainment applied for fitting and projections

The situation continues to change. Models continue to be updated regularly.

Additional Analyses

Overview of relevant on-going studies

Other projects coordinated with CDC and VDH:

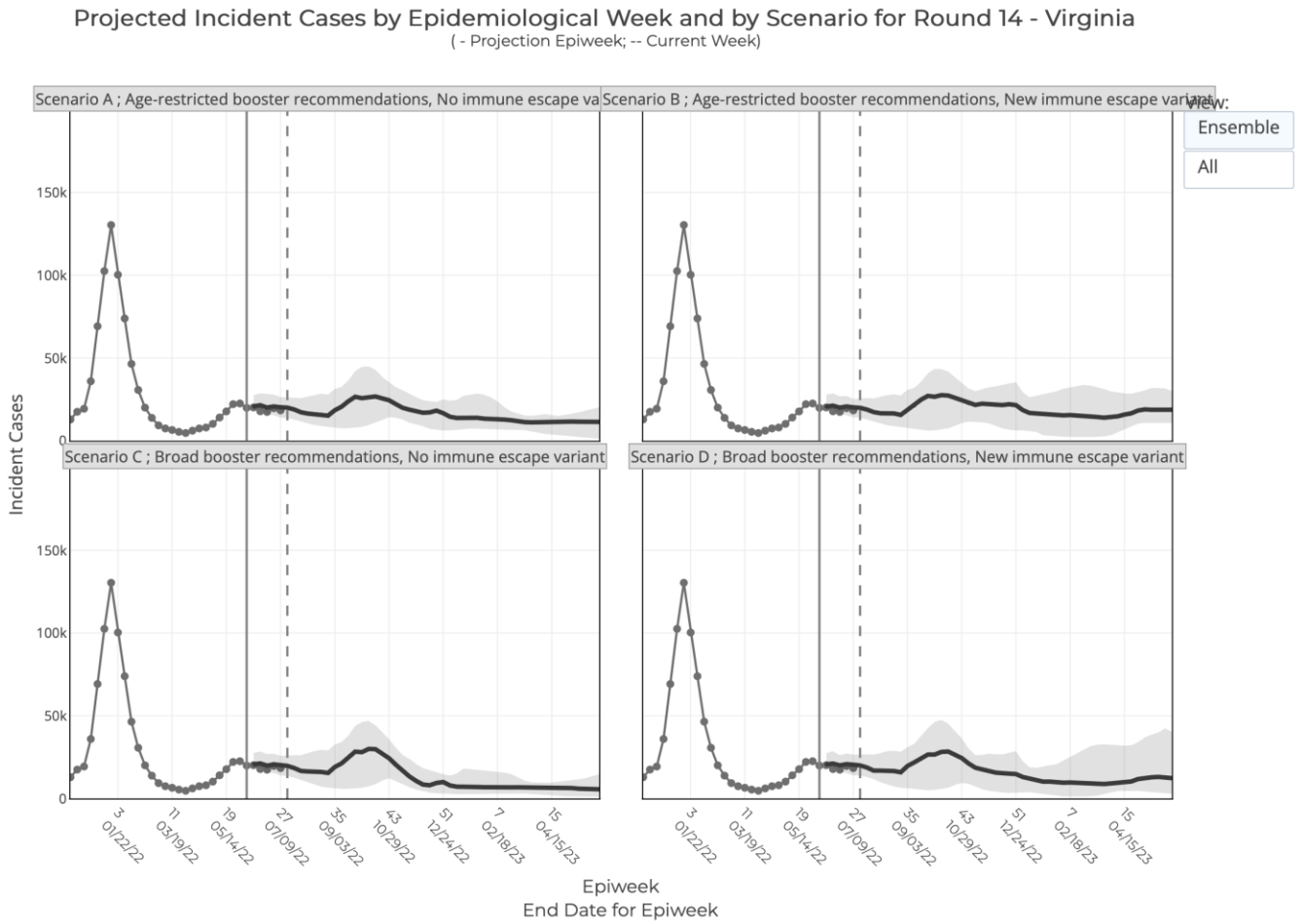
- **Scenario Modeling Hub:** Consortium of academic teams coordinated via MIDAS / CDC to that provides regular national projections based on timely scenarios
- **Genomic Surveillance:** Analyses of genomic sequencing data, VA surveillance data, and collaboration with VA DCLS to identify sample sizes needed to detect and track outbreaks driven by introduction of new variants etc.
- **Mobility Data driven Outreach locations:** Collaboration with VDH state and local, Stanford, and SafeGraph to leverage anonymized cell data to help identify sites most frequently visited by different demographic groups

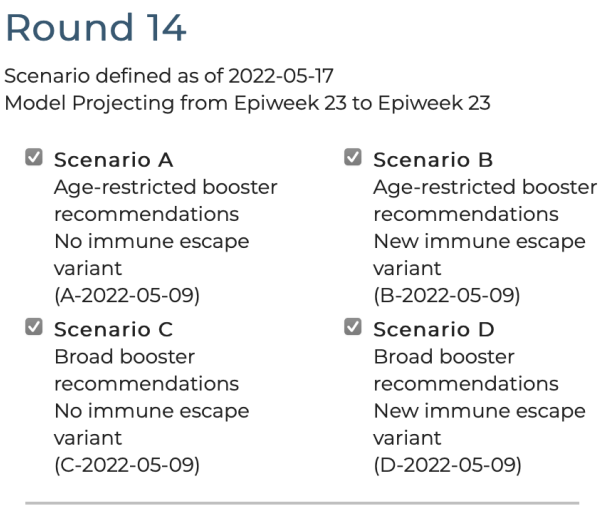
COVID-19 Scenario Modeling Hub – Round 14

Collaboration of multiple academic teams to provide national and state-by-state level projections for 4 aligned scenarios

- Round 14 results getting finalized
  - Scenarios: Test benefits of reformulated fall boosters w/ and w/out a new variant
- Round 15 update being discussed

https://covid19scenariomodelinghub.org/viz.html





Busiest Places: Mobility Data Can Assist

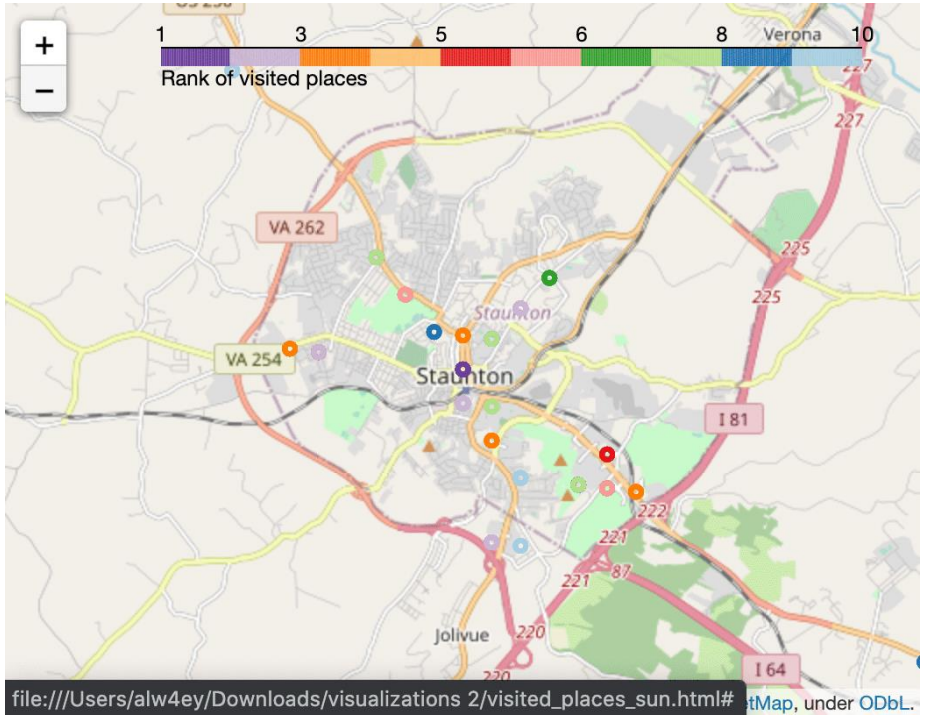
SafeGraph provides fine-grained mobility measures

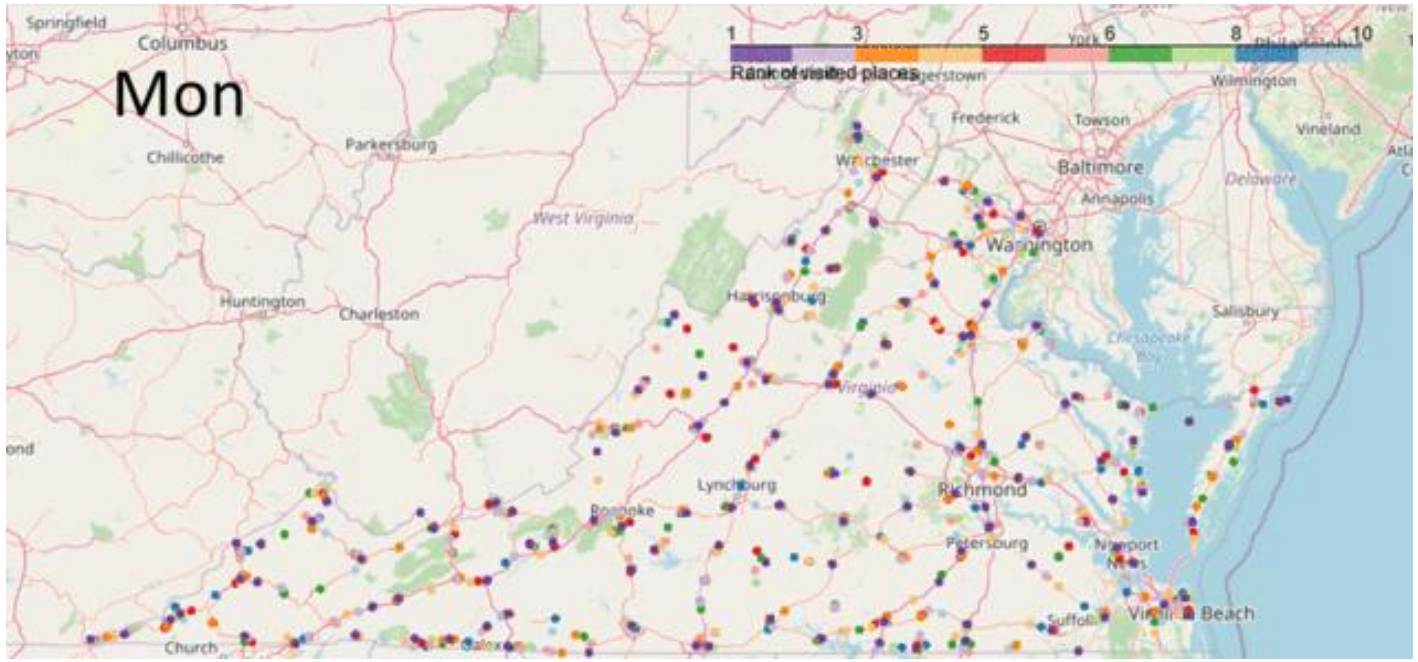
- SafeGraph: anonymized geolocation data aggregated from numerous cell phone apps
- One of the most fine-grained and high-coverage mobility data sources available: 6.4 million POIs in the US; 158,869 POIs in VA
- Has been utilized by hundreds of researchers, governments, and the CDC to aid COVID-19 efforts (Chang, Pierson, Koh, et al., *Nature* 2020; Chang et al, KDD 2021)
- Daily and hourly number of visits to points-of-interest (POIs), i.e., non-residential locations such as restaurants, bars, gas stations, malls, grocery stores, churches, etc.
- Weekly reports per POI of ***where visitors are coming from*** (at the census block group level)
- Still has limitations to be aware of (e.g., less representation among children and seniors)

SAFEGRAPH

Find the Busiest Locations

POIs are individual addresses, need some aggregation to busy areas

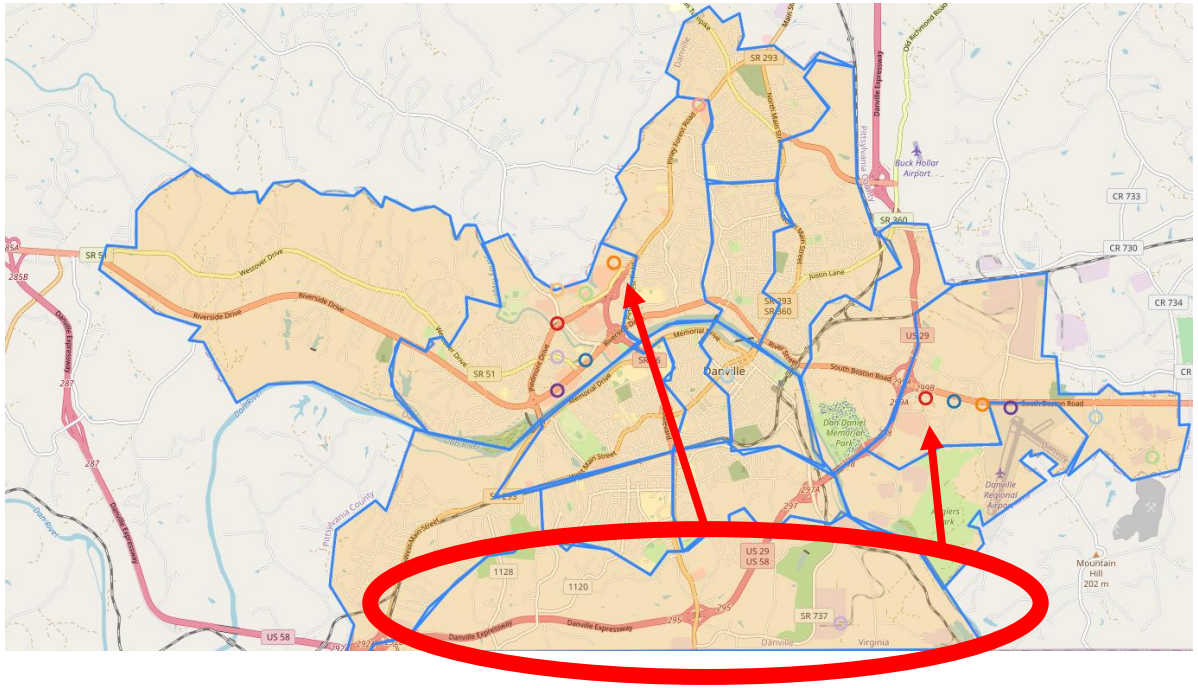




Busiest locations vary by day of week (and time of day)

Find locations visited by Population to Serve

Census Block Groups in Danville



1. Use census data to characterize the populations of the different census block groups
2. Identify most frequently visited POIs for each CBG
3. Cluster most visited POIs
4. Provide potential sites grouped by the demographic groups they likely serve

Goal: Provide frequently visited locations based on populations and vaccination levels one desires to reach

Example: List of locations in the Southside frequented by Black Virginians

Overview of the current roster of targeted populations

These are the current roster of targeted population groups that we are providing as part of the weekly delivery to VDH. (This roster is subject to change.)

- Whole population (eg, no target population filters are applied)
- Race Black
- Ethnicity Latinx
- Ages 20-40
- Ages 20-30
- Ages 30-40
- Unvaccinated populations
- Latinx or Black NEW

Data Elements in the CSV

HighlyVisitedAddress
This is the address of the POI in the L14 that sees the most visits. It is provided to make it easier to find the L14 on the map.

Rank & LocationWeight
The LocationWeight is estimated # of visits to POIs in the L14 from the target group. Rank indicates the order from most- to 25th most-visited

AreaMostVisitedPeriod
This is the 4-hour period in the week when the L14 sees its highest traffic. This is not target group-specifi

NEW

Population Group
For a targeted file like this one, these will all be the same value.

AreaMostVisitedDay
This is the day of the week when most visitors go to this S2 location. This is not target group-specific.

Lat and Lon
This is the latitude and longitude for the center of the L14.

VDH District

S2 Key (L14)

County

Locality	District	PopulationGroup	LocationID	Rank	LocationWeight	AreaMostVisitedDay	HighlyVisitedAddress	AreaMostVisitedPeriod	Lat	Lon
Accomack Cc	Eastern Shor	Latinx or Black	89ba2b55	1	4966.030095	Friday	25297 Lankford Hwy Rt 13 N, C	Friday 17:00-21:00	37.6978738	-75.716796
Accomack Cc	Eastern Shor	Latinx or Black	89ba2caf	2	3728.476605	Friday	26036 Lankford Hwy, Onley, VA	Friday 15:00-19:00	37.6881681	-75.722612
Accomack Cc	Eastern Shor	Latinx or Black	89ba2b57	3	3508.193676	Saturday	25274 Lankford Hwy, Onley, VA	Saturday 13:00-17:00	37.69859	-75.722612
Accomack Cc	Eastern Shor	Latinx or Black	89bbd4ad	4	2582.802769	Wednesday	25102 Lankford Hwy, Onley, VA	Sunday 11:00-15:00	37.7023677	-75.710981
Accomack Cc	Eastern Shor	Latinx or Black	89ba2b53	5	1844.868961	Sunday	25102 Lankford Hwy, Onley, VA	Friday 16:00-20:00	37.7030842	-75.716796
Albemarle Cc	Blue Ridge	Latinx or Black	89b38647	1	14088.0684	Thursday	1215 Lee St, University of Virg	Thursday 07:00-11:00	38.0327733	-78.500766
Albemarle Cc	Blue Ridge	Latinx or Black	89b477ff	2	6999.363545	Saturday	1980 Rio Hill Ctr, Charlottesvill	Saturday 12:00-16:00	38.087391	-78.472353
Albemarle Cc	Blue Ridge	Latinx or Black	89b38645	3	5824.383454	Wednesday	Cabell Hall 525 Mccormick Roa	Wednesday 11:00-15:00	38.033334	-78.506447
Albemarle Cc	Blue Ridge	Latinx or Black	89b3888d	4	5078.488029	Friday	540 Pantops Ctr, Pantops, VA,	Thursday 11:00-15:00	38.0334982	-78.455301
Albemarle Cc	Blue Ridge	Latinx or Black	89b387fd	5	4655.844131	Saturday	100 Twentyninth Place Ct, Cha	Saturday 11:00-15:00	38.077516	-78.478036

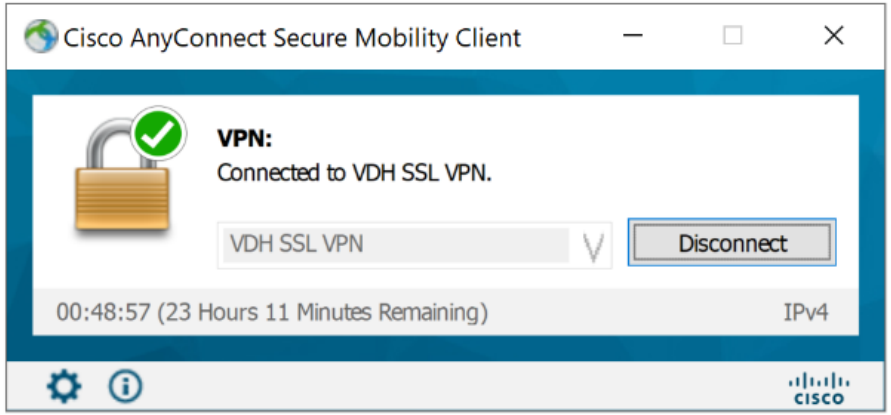
Mobility Data Updated Weekly

Box: https://virginia.box.com/s/03kq8el0kzd9w43wz2g3myozov76uizo

- Excel sheets and simple HTML maps packaged for use

VDH has a dashboard available upon request to allow interactive viewing

- https://arcgis.vdh.virginia.gov/portal/apps/opsdashboard/index.html#/8631cfc4f181460fafc7e1923f41d581
- Dashboard is restricted to VDH offices and those who VPN into the CoV Network



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Biocomplexity Institute. COVID-19 Surveillance Dashboard. https://nssac.bii.virginia.edu/covid-19/dashboard/

Google. COVID-19 community mobility reports. https://www.google.com/covid19/mobility/

Biocomplexity page for data and other resources related to COVID-19: https://covid19.biocomplexity.virginia.edu/

Questions?

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